Fansteel

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March 14, 2001

Mr. John J. O'Grady
Remedial Project Manager
Superfund division
USEPA Region V
77 West Jackson Blvd. [SR-6J]
Chicago, IL 60604-3590

by FedEx

Re: Fansteel Inc – North Chicago – Administrative Order,
Docket No. V-W-00-6-413
Designation of Subcontractor

Dear Mr. O'Grady:

In accordance with paragraph V.2 of the subject Administrative Order, please consider this letter as our notification of a new subcontractor that has been retained to perform work under this Order to implement the Engineering Evaluation/Cost Analysis ("EE/CA"). The new subcontractor is Geotechnics who will perform geotechnical tests on selected soil samples (e.g., for permeability, specific gravity, grain size analysis, and Atterburg limits). A Qualification Statement prepared by Geotechnics is enclosed for your review.

Sincerely,

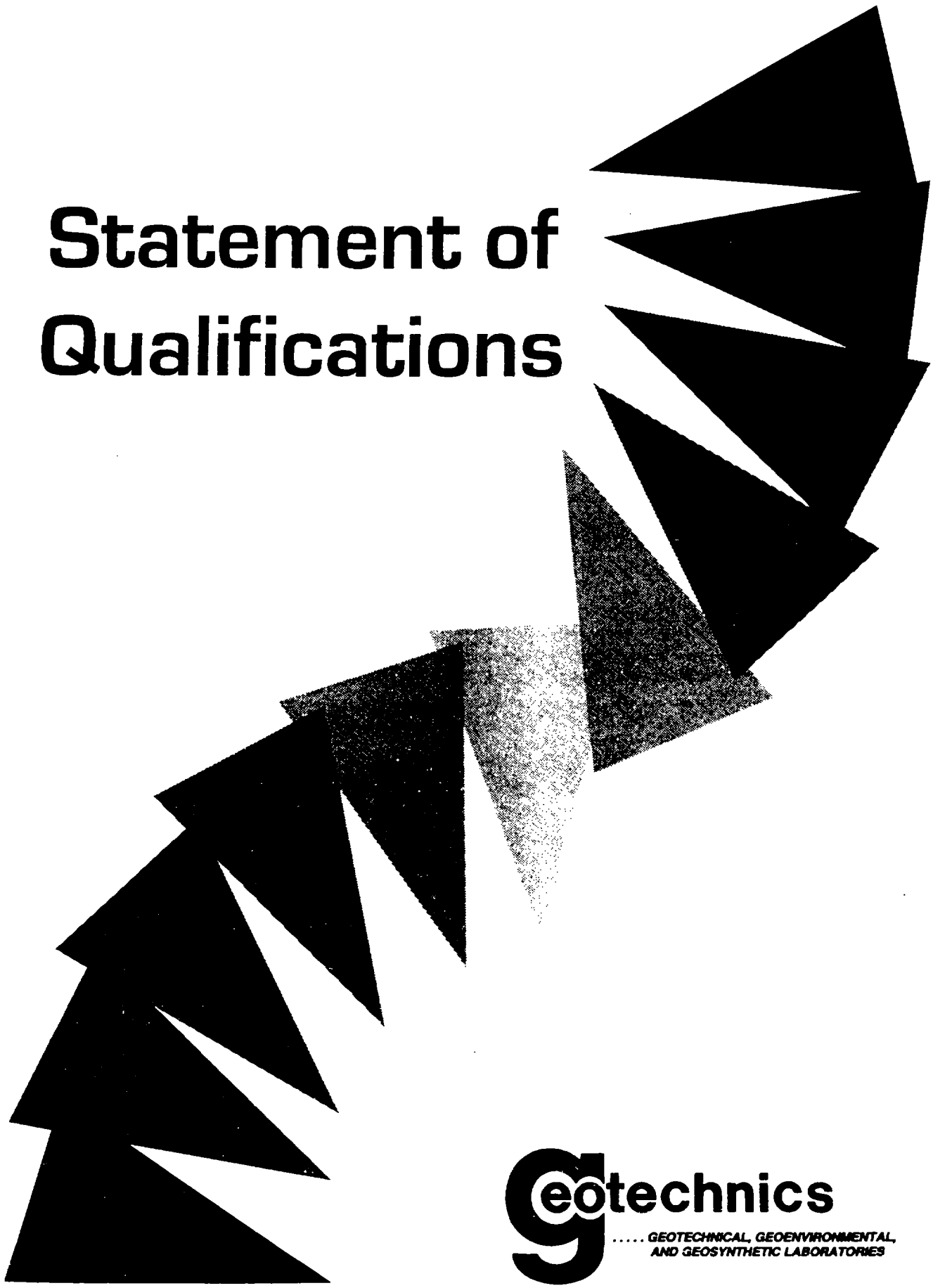
E. Jonathan Jackson

Enclosure – Geotechnics Qualification Statement

cc: Thomas Krueger (Assistant Regional Counsel, USEPA Region V,
77 West Jackson Boulevard, C-14J, Chicago, IL, 60604-3590)
Michael Mocniak (Fansteel)
Mark Steger (McBride Baker & Coles)
Marcel D. Tourdot (Earth Sciences Consulting Inc.)

EPA Region 5 Records Ctr.
229953

Statement of Qualifications



Geotechnics

..... GEOTECHNICAL, GEOENVIRONMENTAL, AND GEOSYNTHETIC LABORATORIES

OUR QUALITY POLICY

Geotechnics is committed to maintaining the professional status and quality of our laboratory. We strive to listen to and understand our clients' needs and act promptly upon their requests. We will dedicate the resources necessary to ensure that the highest levels of quality are continuously being upheld.

Geotechnics

STATEMENT OF QUALIFICATIONS

Since 1984 Geotechnics has provided high quality laboratory testing services throughout the United States for thousands of geotechnical, geosynthetics and geoenvironmental projects. Geotechnics' extensive experience includes testing for earth dams, building foundations, highway construction, waste disposal and fluid containment facilities. Selected project experience and project locations are presented in Appendix A. Geotechnics' headquarters is a 20,000 square foot laboratory located in the Keystone Commons industrial complex in East Pittsburgh, Pennsylvania. The facility was designed from the ground up to be a testing laboratory and utilizes state-of the-art equipment. Geotechnics also operates a laboratory in Raleigh, North Carolina.

QUALITY ASSURANCE PROGRAM

Mr. Richard Lacey PE is the director of the Quality Assurance Department. Mr. Lacey has a BS degree in Civil Engineering and extensive quality management experience. Mr. Lacey has performed Quality Assurance audits on manufacturing facilities, testing laboratories and The Geosynthetic Research Institute located in Drexel University at the request of Mr. George Koerner, Ph.D., P.E. In addition, Mr. Lacey has extensive experience in preparing and reviewing QA/QC manuals for various corporations and specific projects.

The Quality Manager is Mr. Kevin Lichtenfels who holds a BS Degree in Science and has over 11 years of testing experience and over 6 years of equipment calibration and auditing experience. Mr. Lichtenfels has successfully completed the ISO short course entitled Auditing to ISO 9000 Standards.

Geotechnics' Quality Assurance program has been customized to meet the requirements of the following nationally recognized agencies:

- The Geosynthetics Accreditation Institute-Laboratory Accreditation Program (GAI-LAP),
- The American Association of State Highway and Transportation Officials (AASHTO),
- The International Organization for Standardization (ISO-Guide 25 For Laboratories),
- The United States Army Corps of Engineers (COE) and
- The American Council of Independent Laboratories.

The purpose of the Quality Assurance program is to assure that the work performed by Geotechnics is of the highest professional standards and specifically meets the requirements of our clients.

Staff Experience

The combined company staff consists of 25 full- and part-time employees. Eight members of our staff are degreed in the fields of engineering, geology and sciences. Selected resumes, staff education and experience are presented in Appendix B.

Mr. David Backstrom who has over 26 years of experience in the laboratory industry manages the geotechnical laboratory. Mr. Backstrom holds a BS Degree in Civil engineering and is an active member of the ASTM D-18 Committee on geotechnical testing.

Mr. Richard Lacey, PE who has over 16 years of experience with geosynthetics and a BS Degree in Civil Engineering manages the geosynthetic laboratory. Mr. Lacey is an active member of ASTM Committee D-35 on Geosynthetics and is currently the Chairman of the Transmissivity, Radial Transmissivity and Gradient Ratio Task Groups. In addition, Mr. Lacey coordinated the national round robin testing for ASTM D4716 Transmissivity, ASTM D5887 GCL flux and D5993 GCL Bentonite Mass per Unit Area.

Mr. Larry Wetzel who has 6 years of experience and holds a BS Degree in Environmental Geology manages the geoenvironmental laboratory. Mr. Wetzel has extensive experience handling various site soils and materials such as sludge and industrial by-products.

Geotechnics' Accreditation's

Geotechnics has been site audited by various agencies and fully accredited by the:

- Geosynthetics Accreditation Institute-Laboratory Accreditation Program (GAI-LAP)
- The American Association of State Highway and Transportation Officials (AASHTO)
- The International Organization for Standardization (ISO-Guide 25 For Laboratories) and
- The United States Army Corps of Engineers (COE)

Geotechnics was the first laboratory in the United States to achieve the ISO Guide-25 Accreditation offered by AASHTO. Geotechnics is one of a few laboratories to be successfully site audited by The U.S. Army Corps Waterways Experiment Station (WES) located in Vicksburg, Mississippi. Geotechnics has participated over the last ten years in the AASHTO Proficiency sample-testing program. Copies of Geotechnics' accreditations are presented in Appendix C.

QUALITY COMMITMENT

Based on our aggressive interest and commitment to quality, Geotechnics coordinates numerous international round-robin testing for ASTM Task Groups including the following:

- ASTM D4716 for Transmissivity Testing
- ASTM D-5993 Bentonite Mass/Unit Area of GCL's
- ASTM D5887 for GCL Index Flux
- ASTM D-5101 Gradient Ratio
- (Draft) Radial Transmissivity

Geotechnics participated in the following industry round robin programs:

- ASTM D4751 for Apparent Opening Size (AOS)
- ASTM D4491 for Permittivity
- ASTM D5890 for Swell Index
- ASTM D5199 for Thickness
- ASTM D5994 for Textured Geomembrane Thickness

Geotechnics was one of only 13 commercial testing laboratories selected by the ASTM Institute for Standards Research (ASTM/ISR) to participate in a comprehensive inter-laboratory testing program. The program was designed to obtain reliable estimates of precision, reproducibility, and repeatability. Various types of soil samples are distributed to the laboratories for research. The research testing compares data from general classification testing as well as Triaxial, direct shear, unconfined compression, compaction, one-dimensional consolidation and permeability testing.

In addition, Geotechnics participates in the yearly ASTM D-20 Proficiency program for ASTM D1238 Melt Index and ASTM D1505, D792 for Density.
Geotechnics also participates and are members of various organizations that help insure that state of the art testing practices are performed by Geotechnics. Geotechnics or employees are members of the following organizations:

- American Council of Independent Laboratories
- Pittsburgh High Technology Council
- American Society of Testing Materials
- American Society of Civil Engineers
- North American Geosynthetic Society
- American Society of Quality Control
- Association of State Dam Safety Officials
- International Association of Geosynthetic Installers

TESTING CAPABILITIES

Geotechnics provides testing services for geotechnical, geosynthetics, aggregates, geoenvironmental, concrete and rock. A brief summary of our testing capabilities is presented below. A detailed outline of our capabilities is presented in Appendix D.

Geotechnical

Our geotechnical laboratories routinely provide high-quality, responsive testing services for projects ranging in scope from a few samples with basic classification tests to several hundred samples with a complex series of characterization, compaction, consolidation, strength and permeability tests. Geotechnics features an extensive range of permeability testing capabilities with rigid and flex-wall permeameters ranging from 3 to 12 inches in diameter. We are equipped to test over 40 three-inch diameter flex-wall samples simultaneously

Geosynthetics

The geosynthetic laboratory is equipped with three Tinius Olsen universal test machines to handle the most demanding project schedules. Geared for quality and service, Geotechnics has developed innovative apparatus and fixtures designed to maximize the accuracy and precision of the test results while accelerating the turnaround. In addition to the full range of routine conformance testing capabilities, Geotechnics has a 12-inch direct shear apparatus with data acquisition, which can apply loads up to 25,000 pounds per square foot. We also have a wide width testing machine, which can handle high strength geotextiles and geogrids with breaking strengths over 4,000 pounds per inch.

Geoenvironmental

Our geoenvironmental laboratory performs general classification testing on select impacted soils to help determine the appropriate remediation or

containment measures. Geotechnics has extensive experience in sludge stabilization often encountered on industrial sites. Our experience includes preparing and testing site materials blended with various add-mixtures, such as fly ash, bottom ash, Bentonite, cement and kiln dusts in varying proportions to optimize the strength, workability and economics. Geotechnics has been involved with numerous slurry wall designs throughout the United States, from material selection to laboratory testing. Our experience includes characteristic testing with various types of Bentonite blends, including Marsh Cone, Mud Balance, free swell and confined swell tests. We also provide strength testing of stabilized cubes.

Aggregates

Geotechnics is AASHTO accredited to perform various types of sieve analysis with our large Gilson sieve shaker along with Specific Gravity on coarse and fine aggregates. We also perform Relative Density with the vibratory table, Carbonate analysis and soundness testing. We can also test aggregates in our 4"-12" rigid-wall permeameter while subjected to compressive loads in excess of 25,000 pounds per square foot. The test is capable of determining permeability's as fast as 50 cm/sec.

Concrete and Rock

Geotechnics provides Unconfined Compression testing of concrete cylinders along with grout and mortar cubes. We also have experience performing freeze thaw testing on bricks. Geotechnics also provides Unconfined Compression testing of rock core along with Point Load tests. A digital camera is utilized to present a color photograph of the rock core after failure on the unconfined data sheet. In addition, Geotechnics performs slake durability and soundness testing.

DATA COLLECTION AND PRESENTATION

Geotechnics currently maintains a computer network system for the purpose of data reduction in an easy to read report ready format for all of our testing services. A data acquisition system is utilized to collect data from selected tests and is also presented in a report ready format. The data sheets can also be formatted to comply with project specific requests. Selected samples of data sheets are presented in Appendix E.

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APPENDIX A

SELECTED CLIENT LIST AND PROJECT EXPERIENCE

Geotechnics

Selected Client List

CONSULTANTS

American Geosciences, Inc.
Almes & Associates, Inc.
AWK Consultants
Baker Environmental Corp.
Civil & Environmental Consultants, Inc.
Cummings Ritter Consultants, Inc.
Cumberland Geotechnical Consultants,
D'Appolonia Engineers
Earth Science Consultants
ETE Consultants, Inc.
Earth Tech, Inc.
Blasland, Bouck & Lee, Inc.
Bunnell & Lammons Engineering
Jacobs Engineering
G.N. Richardson, Inc.
Malcolm Pirnie, Inc.
McMahon & Mann Consulting
HDR Engineering of the Carolinas
HDR Engineering of Pittsburgh
Michael Baker Jr. Engineers, Inc.
CE Consultants, Inc.
CTI & Associates, Inc.
Geraghty and Miller, Inc.
Glynn Geotechnical Engineering
Golder & Associates, Inc.
The IT Group
L. Robert Kimball & Associates
MSES Consultants, Inc.
Murray & Associates, Inc.
NTH Consultants, Inc.
P.C. Rizzo and Associates
SEC – Geotech, Inc.
STS Consultants, Ltd.
Triad Engineering, Inc.
Vapco Engineering
Woodward & Curran Engineers
Woodward-Clyde Consultants
GAI Consultants. Inc.
SE Technologies, Inc.
Blazosky Associates, Inc.
Killam & Associates
PSI, Inc.
Vector Engineering, Inc.
Environmental Strategies Corp.
Dames & Moore, Inc.
Philip Environmental
Gannett Fleming, Inc.
ICF Kaiser Engineers, Inc.
GZA Geoenvironmental, Inc.
ENSR, Inc.
Sverdrup Environmental, Inc.
Law Environmental Service, Inc.
Jeff Zell Consultants
Key Environmental, Inc.
CH2M Hill, Inc.
Radian International, Inc.

GOVERNMENT AGENCIES

United States Army Corps of Engineers
United States Air Force
Department of the Navy
Pennsylvania Dept. of Transportation
North Dakota Dept. of Transportation
Allegheny County, Pennsylvania
Pennsylvania Turnpike Commission
U.S. Bureau of Mines
State of Montana Conservation

SPECIALTY CONTRACTORS

Atlas Construction, Inc.
Delaney Construction, Inc.
Environmental Liners, Inc.
Ground Improvement Techniques, Inc.
J.A. Jones Environmental
Nicholson Construction of America
Sevenson Environmental Services
OHM Corporation, Inc.
Construction Technology
Harding Lawson & Associates
Geo-Con, Inc.
Glover Construction, Inc.
Noralco Corporation
Lane Construction Corporation

INDUSTRIAL CLIENTS

Allegheny Power Services Corp.
Allied Signal, Inc.
Arco Chemical Company
GSX Corporation
Babcock & Wilcox
Dravo Corporation
National Seal Company
Shell Corporation
Tensar Corporation

SOLID WASTE

Browning Ferris Industries
Waste Management, Inc.
Rumpke
Laidlaw
American Waste Services
Kelly Run Sanitation
Mon. Auth. of Westmoreland County
Northern Tier Solid Waste Authority
Superior Services, Inc.

Transamerican Waste Industries, Inc.
United Waste Systems, Inc.
White Pines Corporation

LANDFILLS

Valley Landfill, Pennsylvania
Arden Landfill, Pennsylvania
East Liverpool, Ohio
Greentree, Pennsylvania
Muskingham, Ohio
Coshocton, Ohio
Arnoni, Pennsylvania
Peter's Creek, Pennsylvania
Kelley Run, Pennsylvania
Lakeview, Pennsylvania
Seneca, Pennsylvania
Charleston County
Pine Grove, Pennsylvania
Turnkey, New Hampshire
Corinna, Maine
Old Town, Maine
Schyler Falls, New York
Greenbrier County, West Virginia
Cuyahoga, Ohio
Rotterdam, New York
Bethlehem, Pennsylvania
Johnstown, Pennsylvania
Kellog, Indiana
Queens, New York
George County, Virginia
Vinland, Pennsylvania
Kimble Clay, Ohio
Lee County Landfill, South Carolina
Big Hill Landfill, New Jersey
West Kentucky, Kentucky
Buckeye Landfill, Ohio
Raleigh County, North Carolina
LCS Landfill, West Virginia
Dauphin Meadows, Pennsylvania
Mahoning, Ohio
Carbon, Ohio
Meadowfill, West Virginia
Superior Greentree, Pennsylvania
Evergreen Landfill, Pennsylvania
Greenridge, Pennsylvania
North West Sanitary, Pennsylvania
North Fork, West Virginia
Southern Alleghenies, Pennsylvania
Hyland Landfill, New York
Hakes Landfill, New York
McKean County, Pennsylvania
Hartland, Maine
Webster County
Colonie Landfill, New York
Osborne Landfill, Ohio
Imperial Landfill, Pennsylvania
Salem Landfill, New York
Northeast Landfill, South Carolina
Onslow Landfill, North Carolina
Indian Lake Landfill, New York
Wyandot, Ohio
Fulton County, Delaware
B & E Landfill, Ohio
Edgemere, New Jersey
Ottawa Landfill, Ohio
Delaware S.W.A., Delaware
Horry County, North Carolina
Dow Corning, Pennsylvania
Foothills Landfill, South Carolina
Brunswick Landfill, New York
Ellery Landfill, New York
Blackfoot Landfill, New York
Brunner Landfill, Pennsylvania
Anderson Landfill, North Carolina
Laurel Highlands, Pennsylvania
American, Ohio
Monroeville, Pennsylvania
Imperial, Pennsylvania
Willow Creek, Ohio
Hughes Road, Ohio
Pellegrene, Pennsylvania
Helen Kramer, New Jersey
Tucker County, West Virginia
Mountain View, Pennsylvania
Deep Valley, Pennsylvania
Brooke County, West Virginia
Sanitary Landfill, Pennsylvania
Modern, Pennsylvania
Chrin Brothers, Pennsylvania
Town of Lincoln, Maine
Rodman, New York
Lewistown, Pennsylvania
Birch Run, Pennsylvania
Cecos, New York
Kness, Pennsylvania
Blosenski, Pennsylvania
Lac Duflambecu, Canada
Mooers, Pennsylvania
Westwood Landfill, New Jersey
Fort Meade, Virginia
Garrett County Landfill, Maryland
High Acres Landfill, New York
Honey Go Run Landfill, Maryland
Mohawk Valley, New York
Mifflin County, Pennsylvania
Ontario Landfill, New York
Hanes Landfill, North Carolina
Butler County Landfill, Pennsylvania

Geotechnics

SELECTED PROJECT EXPERIENCE
GEOTECHNICAL LABORATORY

Project Description & Location	Type of Service	Estimated Costs
A stability analysis for an electrical power dam operated by Santee Cooper located in South Carolina. Geotechnics performed the testing for P.C. Rizzo & Associates.	Geotechnics provided Triaxial strength testing along with classification testing to evaluate the slope stability of an earth dam.	$ 30,000
Remediation of the Chanute Air Force Base located in Rantoule, Illinois. Geotechnics performed the testing for Jacobs Engineering.	Geotechnics provided classification testing along with Triaxial, Consolidation, Unconfined Compression and Permeability testing for the project.	$50,000
Foundation design for The Woodrow Wilson Bridge located in Washington D.C.. Geotechnics performed the work for Thomas L. Brown and Associates.	Geotechnics provided classification testing along with Triaxial, Direct Shear and Unconfined Compression testing for the project.	$30,000
Quality Control for the construction of the Buckeye Landfill located in Ohio. Geotechnics performed the testing for Blazosky & Associates, Inc.	Geotechnics provided classification testing along with Triaxial, Direct Shear and permeability testing for the project.	$80,000
Stabilization of a moving hillside overlooking a river In Hickmans Bluff, Kentucky. The testing was performed through D'Appolonia Engineers for The U.S. Army Corps of Engineers.	Geotechnics performed Triaxial strength testing for very stiff site soils.	$ 10,000
Earth Dam evaluation for 6 dams located in Montana. The testing was performed for The State of Montana Department of Natural Resources and Conservation.	Geotechnics provided classification testing along with Triaxial, Direct Shear and Unconfined Compression testing for the project.	$12,000
Construction of a 15 feet wide and 60 feet high, high-wall barrier. The site was located in Pennsylvania. Geotechnics performed the testing for Almes & Associates.	Geotechnics provided classification and strength testing services for the project. In addition, the testing included 12-inch flex-wall permeability tests.	$ 40,000
Various sanitary landfills operated by Waste Management Systems located in Ohio and Pennsylvania.	Geotechnics provided classification and strength testing for the construction of various landfills.	$100,000
Evaluation of strip mine spoil for The U.S. Bureau of Mines located in Pittsburgh, Pennsylvania.	Geotechnics provided classification and strength testing on strip mine spoil utilized for backfill material.	$8,000
Various sanitary landfills operated by Allied Waste formerly Browning Ferris Industries located in Ohio and Pennsylvania.	Geotechnics provided classification and strength testing for the construction of various landfills.	$100,000
Construction of a Staging area for the fabrication of a concrete dam that will be utilized to replace the existing Braddock Dam on the Monongahela River in Pittsburgh, Pennsylvania. Geotechnics performed the testing for P.C. Rizzo & Associates and The U.S. Army Corps of Engineers..	Geotechnics provided classification testing along with Triaxial and Direct Shear testing for the project.	$10,000
Foundation design for the Pittsburgh Convention Center Expansion located in Pittsburgh, Pennsylvania. Geotechnics performed the testing for D'Appolonia Engineers.	Geotechnics provided classification testing along with Triaxial, Direct Shear and Unconfined Compression testing for the project.	$6,000

Geotechnics

SELECTED PROJECT EXPERIENCE
GEOSYNTHETIC LABORATORY

Project Description & Client	Type of Service	Estimated Costs
A sanitary landfill operated by The Southern Public Service Authority (SPSA) located in Virginia. We performed the work for HDR Engineering of the Carolinas.	Geotechnics provided geosynthetic conformance testing for geomembranes, geotextiles and geogrids. In addition, Geotechnics coordinated the in-plant sampling and performed the destructive seam testing.	$60,000
The Turnkey sanitary landfill located in New Hampshire. Geotechnics performed the work for Waste Management.	Geotechnics provided geosynthetic conformance testing for geomembranes, geotextiles and geogrids. In addition, performed the destructive seam testing.	$40,000
The Huron City landfill located in Ohio. Geotechnics performed the work for Malcolm Pirnie .	Geotechnics performed interface friction testing utilizing the large direct shear box. Various types of materials were tested.	$20,000
Various Highway construction projects over the past 4 years for the North Dakota Department of Transportation located in North Dakota.	Geotechnics provided geosynthetic conformance testing for geomembranes, geotextiles and geogrids.	$60,000
Numerous sanitary landfills operated by Allied Waste formerly Browning Ferris Industries (BFI) located in Ohio and Pennsylvania.	Geotechnics provided geosynthetic conformance testing and destructive seam testing for geotextiles.	$60,000
On site QA/QC testing at The A/A manufacturing plant located in Massachusetts. The plant has since relocated.	Performed on site QA/QC activities, selected samples and performed the conformance testing on the geomembranes.	$25,000
Environmental project for a chemical plant located in Buffalo, New York.	Performed 9090 Compatibility testing on geomembranes with site leachates.	$12,000
A residual waste facility used for coal refuse storage located in Homer City, Pennsylvania.	Geotechnics provided geosynthetic conformance testing for geomembranes, geotextiles and geogrids.	$80,000
A Fly Ash residual waste storage facility located in Shelocta, Pennsylvania.	Geotechnics provided geosynthetic conformance testing for geomembranes, geotextiles and geogrids.	$100,000
A Fly Ash residual waste storage facility located in Homer City, Pennsylvania.	Geotechnics provided geosynthetic conformance testing for geomembranes, geotextiles and geogrids.	$50,000
Numerous sanitary landfills operated by Waste Management located in Pennsylvania.	Geotechnics provided geosynthetic conformance testing and destructive seam testing for geotextiles.	$60,000
The Delaware City landfill operated by The Delaware City Sanitary Waste Management Authority located in Maryland. Geotechnics performed the work for Atlantic Testing.	Geotechnics performed interface friction testing utilizing the large direct shear box. Various types of materials were tested.	$15,000

Geotechnics

SELECTED PROJECT EXPERIENCE
GEOENVIRONMENTAL LABORATORY

Project Description & Location	Type of Service	Estimated Costs
A slurry wall design used for site containment of a pesticide plant located in Jacksonville, Florida.	Geotechnics performed general soil classification testing and permeability testing with various add-mixtures.	$10,000
A sludge stabilization project located in Allentown, Pennsylvania. Geotechnics performed the testing for ICF Kaiser.	Geotechnics performed general soil classification, compaction, permeability and strength testing with various add-mixtures to determine the optimum moisture content and percentage of sludge stabilizers.	$16,000
A sludge stabilization project located in Henderson, Nevada. Geotechnics performed the testing for ICF Kaiser.	Geotechnics performed wetting and drying durability testing along with constant head permeability and bulk density. Leachate was also collected from the permeability samples for analysis.	$8,000
Compatibility and stabilization testing for a confidential site. Geotechnics performed the work for Shannon & Wilson Company	Geotechnics evaluated several various Bentonite slurry wall mixtures compatibility with site fluids. The testing included filter cake, filter cake permeability and paint filter testing.	$10,000
A slurry wall design used for the site containment of a steel mill waste located in Pittsburgh, Pennsylvania.	Geotechnics evaluated the Bentonite slurry with site leachates for long-term permeability testing.	$ 10,000
A slurry wall design used for containment of a creosote plant located in Chicago, Illinois.	Geotechnics evaluated the Bentonite slurry with site leachates with long-term permeability testing.	$ 30,000
Stabilization of residual waste located in Monroe, Michigan. Geotechnics performed the testing for J.A. Jones Construction.	Geotechnics performed general soil classification testing and sludge stabilization testing with various add-mixtures.	$ 50,000
A testing program to evaluate paper pulp to be utilized as a landfill closure located in Clarksburg, West Virginia. Geotechnics performed the testing for MSES Consultants.	Geotechnics performed general soil classification, compaction, permeability and strength testing to evaluate paper pulp waste for use as a construction material.	$ 25,000
Stabilization of a residual waste located in Morgantown, West Virginia.	Geotechnics performed general soil classification testing and sludge stabilization testing with various add-mixtures	$ 10,000
A slurry wall design used for containment of heavy metals and oils for a site located in Chicago, Illinois.	Geotechnics evaluated the Bentonite slurry with site soils and leachates for permeability testing.	$ 10,000
A slurry wall design used for containment of materials in a smelting plant located in Albany, New York.	Geotechnics performed general soil classification, compaction, permeability and strength testing to evaluate the compatibility of the site soils and various add-mixtures.	$ 15,000
A slurry wall design used for containment of materials in an industrial plant located in Pawtucket, Rhode Island.	Geotechnics performed general soil classification, compaction, permeability and strength testing to evaluate the compatibility of the site soils and various add-mixtures.	$ 8,000

APPENDIX B

STAFF EXPERIENCE AND RESUMES

Geotechnics

EMPLOYEE EDUCATION AND EXPERIENCE

Employee	Title	Education & Certification	Years of Experience
Randy O'Rourke	President	BS, Engineering Special Fields, University of Pittsburgh	26
David Backstrom	Vice President	BS, Civil Engineering, University of Pittsburgh OSHA 40-Hour Hazardous Waste Training	27
Robert Snow	Secretary	PE, MS, Civil Engineering, Michigan State University OSHA 40-Hour Hazardous Waste Training	19
Richard Lacey	Quality Assurance and Laboratory Director	PE, EIT, BS Civil Engineering University of Pittsburgh ASTM-Chairperson-Various Task Groups	18
David Jenks	Laboratory Manager	AS, Construction Technology Williamsport Community College NICET Level II, Soil, Concrete, Asphalt ACI-Grade I OSHA 40-Hour Hazardous Waste Training	14
Kevin Lichtenfels	Quality Assurance Manager	BS, Anthropology University of Pittsburgh Short Course, BSI Auditing to ISO 9000 OSHA 40-Hour Hazardous Waste Training	10
Larry Wetzel	Project Coordinator	BS, Environmental Geology University of Pittsburgh OSHA 40-Hour Hazardous Waste Training	4
Michel Smith	Project Coordinator	BS, Environmental Science Northland College North Carolina DOT, Certified	6
James Moyer	Project Coordinator	AS Studies, Civil Engineering Allegheny Community College OSHA 24-Hour Hazardous Waste Training Short Course-Triaxial & Permeability Tests	12
Anthony Miglio	Technician	BS Studies, Engineering University of Pittsburgh OSHA 40-Hour Hazardous Waste Training	8
Jamie Bard	Technician	High School Graduate	8
Robert Staduhar	Technician	High School Graduate	8
Timothy O'Rourke	Technician	OSHA 40-Hour Hazardous Waste Training High School Graduate	9
John Petrovay	Technician	OSHA 40-Hour Hazardous Waste Training High School Graduate	8
Glen Ustazewski	Technician	Computer Science, Certificate, Computer Technical School OSHA 40-Hour Hazardous Waste Training	12
Bob Finlay	Technician	OSHA 40-Hour Hazardous Waste Training High School Graduate	12
Daniel Abaray	Technician	High School Graduate	2
Dana Backstrom	Technician	BS, Finance West Virginia University	8
Jamie Ayers	Technician	BS, Education Virginia Commonwealth University	2

Richard S. Lacey PE

Laboratory Director-Quality Assurance Director

Background

With over ten years of hands-on experience in geosynthetic testing, Mr. Lacey is the director in charge of all geosynthetic laboratory testing. He manages the geosynthetic operations including acquisition, design and fabrication of the requisite equipment, quality control and assurance, technician training and qualification, and data reduction and reporting. He directs business management and marketing efforts, and insures the testing services are consistent with or exceed industry standards for precision and accuracy.

Mr. Lacey is also the Quality Assurance Director and is responsible for the overall QA/QC program. Mr. Lacey has experience in preparing QA/QC Manuals for laboratories and performing audits to document the test procedures.

Education & Qualifications

P.E. License, March 12,1987 Civil Engineering (Pennsylvania)
E.I.T. Certification, March 1, 1983
B.S., Civil Engineering, University of Pittsburgh, 1982

ASTM Committee D-35 on Geosynthetics

1. Task Group Chairman for Transmissivity Task Group since 1994. Prepared latest revision to 4716-87 now ASTM 4716-95 "Flow Rate per Unit Width and Transmissivity. Completed international round robin program to prepare the precision statement for geonets and geonet/geotextile composites. Continuing work on round robin for geotextiles and edge drains.

2. Task Group Chairman for Gradient Ratio Task Group since 1996 to research alternative soil placement procedures for task group.

3. Round Robin Coordinator for GCL Flux and Bentonite Mass/Unit Area.

Publications

1. Managed large-scale interface friction test involving a 4' X 8' tilt-table constructed from a dump truck bed. Test results were published in a paper titled "Design and Testing of a Landfill Cover with Geomembrane" by N. Paruvakat, G.W. Sevick, J Boschuk Jr., and S. Kollodge, ASTM STP 1081 "Geosynthetic Testing for Waste Containment Applications."

2. "In The Lab Article" for Geotechnical Fabrics Report titled "Transmissivity Testing: State of the Practice", April 1995.

3. "In The Lab Article" for Geotechnical Fabrics Report titled "Manometry: A Laboratory Tool", October/November 1996.

4. "In The Lab Article" for Geotechnical Fabrics Report titled "Radial Transmissivity: An Alternative Test Method", June/July 1998.

Experience

Mr. Lacey joined Geotechnics in 1992 with nearly eleven years of geotechnical and geosynthetics testing experience. Mr. Lacey has gained extensive experience working with Geotechnics and other nationally recognized firms. A list of his experience is listed below:

- Development and Management of Geosynthetic Testing Laboratory specializing in conformance testing services. Acquired the equipment which included both commercially available testing equipment as well as State of the Art prototype testing apparatus requiring design and fabrication. Established complete QA/QC program including development of the detailed procedures, calibration requirements and data sheets for all testing performed. Responsible for all aspects of the lab services including technician training, supervision, data review and reporting.

- While working with another firm Mr. Lacey developed laboratory capabilities for testing geosynthetic materials including acquiring equipment, designing and fabricating specialty apparatus, establishing QA/QC system, writing standard test methods, and preparing the technician training program. Responsible for all aspects of geosynthetic services including marketing and sales, and reporting. Also responsible for operation of the Safety Eye Lab.

- Managed geosynthetic testing laboratory offering fast-track service for conformance and performance testing of all types of geosynthetics. Developed testing programs modeling project specific liner section configurations under various loading and hydraulic conditions.

- Primarily responsible for technical sales support of geotextiles and composite drainage boards. Outside sales also of materials for concrete construction including form-ties, curing and sealing compounds, joint sealants, floor hardeners and toppings, bridge deck overlayments, epoxy bonding and sealing systems, etc.

- Supervision of all aspects of subsurface investigations including proposals, test borings, laboratory testing programs, engineering and analysis and reports and the subsequent construction inspection services. Projects included building foundations, pavement design, slope stability and landslides retaining walls, earth dams, control of compacted fills and pavement distress studies.

Dave Backstrom
Laboratory Director

Background

With over twenty five years of experience in laboratory testing, supervision and management, Mr. Backstrom directs the overall laboratory operation to include administrative business management, marketing and business development. Mr. Backstrom provides expert consultation and technical assistance regarding the specifications of testing programs, interpretation of test results, and coordination and consultation on other technical matters.

Education

B.S., Civil Engineering University of Pittsburgh, Pennsylvania
Short course in Geotechnical Testing, University of Missouri
A.S. Civil Engineering Technology, Community College of Allegheny County,
Forty Hour Health and Safety Training, Center for Hazardous Materials

Affiliations

American Society of Testing Materials
American Society of Civil Engineers
American Council of Independent Laboratories

Experience

Mr. Backstrom joined Geotechnics in 1989 with nearly fifteen years of geotechnical testing experience. Mr. Backstrom has gained extensive experience working with Geotechnics and other nationally recognized firms. A list of his experience is listed below:

- Responsible for overall management and supervision of laboratory services, including coordination and review of testing activities, review of quality control programs, and preparation of testing reports. Responsible for managing laboratory technicians in the performance of geotechnical testing services.

- While working with IT Corporation, Mr. Backstrom was responsible for overall management and supervision of the Pittsburgh laboratory activities, including the internal coordination of laboratory support for the IT Corporation regional offices and review, proposal preparation, marketing of analytical services, and implementation and review of quality assurance/quality control programs in the laboratory. Responsible for managing seventy personnel working in the Pittsburgh facility. Also

responsible for overall management of analytical services according to U.S. Environmental Protection Agency (EPA) Contract Laboratory Program (CLP) protocols for Hazardous Substance List (HSL) compounds, the geotechnical laboratory, and all other environmental laboratory testing for air, water, wastewater, hazardous waste, soils and solids.

- While working with D'Appolonia Engineers, Mr. Backstrom was involved with several projects covering a wide range of civil engineering aspects, including construction monitoring and documentation; design and construction and of surface drainage facilities; computer modeling of earth slopes for stability analysis; permit preparation for mining facilities in Ohio and Pennsylvania; drilling, sampling, and preparation of boring logs for geotechnical testing and design; well monitoring, sampling, and testing of water samples for environmental studies; field testing to provide quality assurance of facilities; and assisting in report preparation and documentation. Geotechnical testing duties included classification testing of soils, permeability, direct shear testing, triaxial shear, cyclic triaxial, field inspection of placement of reinforcement concrete, and field inspection of engineered backfills.

- While working with Atlas Railroad Construction Mr. Backstrom was involved directly with the bidding and implementation of many railroad construction projects. Duties included preparation of bid documents, attending pre-bid conferences with clients, construction scheduling and planning evaluate of clients needs and providing alternatives for proposed construction activities, and procurement of materials, men, and equipment for execution of railroad construction projects.

Dave A. Jenks
Laboratory Manager

Background

Mr. Jenks joined Geotechnics in 2000 as the Laboratory Manager for the Raleigh, North Carolina Facility. Prior to joining Geotechnics, Mr. Jenks was with Van Der Horst Geotechnical Engineering P.C. since 1993. Mr. Jenks also had additional experience prior to 1993. Mr. Jenks has gained extensive hands on experience in the laboratory for general classification testing, along with compaction and flex-wall permeability testing. Mr. Jenks also has extensive construction monitoring experience on typical geotechnical projects. Mr. Jenks also performs the data reduction along with report preparation and client discussions.

Education

AS, Construction Technology, Williamsport Community College

Certifications

NICET Level II - Soil, Asphalt, Concrete and Troxler Certification
ACI – Grade I
New York State Asphalt Pavement Association
North Carolina Asphalt Paving Certification
OSHA 40-Hour Hazardous Waste Training.

Experience

- Manager for the geotechnical laboratory. Responsibilities included preparing daily schedules for testing along with preparation of samples for various tests. Other duties included review of the data, report preparation and meeting with the clients. Mr. Jenks also performed equipment calibration.

- Senior Engineering Inspector for the Kerr Lake Dam project, where over 200,000 cubic yards of soil were placed and compacted. Duties included working with the Army Corps of Engineers to plan the various work stages and testing. Other duties included in-place density testing, laboratory soil classification, preparation of daily reports and documenting construction quantities.

- Senior Engineering Inspector for the RDU North Ramp project where new hangers and taxiways were being constructed, along with new sewer and

water lines and other utilities. Duties included testing and inspection of asphalt, soil, and concrete, attending FAA meetings, working with various subcontractors and project engineers, documenting changes to job specifications and plans.

- As a member of the Engineering/Testing staff at Van Der Horst, Mr. Jenks had diverse responsibilities which included engineering field inspection and testing, and laboratory analysis for numerous construction projects.

- Mr. Jenks was assigned to a forty million dollar Hospital Expansion Project. Responsibilities included full-time construction inspection and testing services. Mr. Jenks was also responsible for preparing daily progress reports and daily scheduling to the owners representatives on site and over-seeing the duties of as many as eight technicians.

- Prior to joining Van Der Horst in 1994, I was associated with Empire Soils Investigations, Inc. Henrietta, New York. While with the firm, Mr. Jenks worked as a technician performing construction monitoring which included an asphalt batch plant inspection for the New York State Department of Transportation. Other tasks included In-place density testing, concrete inspection, core drilling for concrete & asphalt evaluation, fireproofing inspection and laboratory analysis.

Kevin Lichtenfels
Quality Assurance Manager

Background

Mr. Lichtenfels joined Geotechnics in 1987 as a laboratory technician. In that position, he has gained extensive experience in soil classification testing as well as compaction, permeability, strength and consolidation. Mr. Lichtenfels has also performed geosynthetic conformance and destructive peel and shear testing. Mr. Lichtenfels is the Quality Assurance Manager and is responsible for the calibration and record keeping of all laboratory equipment and quality control functions.

Education

Short Course, BSI Auditing to ISO 9000 Standards
Short Course, Excel, Community College of Allegheny County
B.S. Degree, Anthropology, University of Pittsburgh
B.S. Studies, Biology, University of Miami.
OSHA 40 Hour Haz-Wop Training with Yearly 8 Hour Refresher
Member American Society for Quality

Experience

Mr. Lichtenfels is very experienced in classification, compaction and strength testing of soils and conformance testing of geosynthetic materials. Mr. Lichtenfels has extensive experience performing equipment calibration along with the appropriate record keeping activities. As the Quality Assurance Manager Mr. Lichtenfels is responsible for maintaining our current accreditations, and chairs the monthly meeting of the Quality Assurance Committee. A selected list of Mr. Lichtenfels' experience follows:

- Mr. Lichtenfels is responsible for the Quality Assurance and Control for the geotechnical, geoenvironmental and geosynthetic laboratories and continually updates equipment as needed.

- Mr. Lichtenfels is responsible for updating the Quality Assurance files and records in regard to employee training, laboratory accreditation and computer software.

- Mr. Lichtenfels conducts calibration evaluations and records of the laboratory equipment.

- Mr. Lichtenfels has performed interface friction testing on various soils and geosynthetic materials.

- Mr. Lichtenfels is experienced in the processing of geosynthetic materials including sample preparation, specimen die cutting, conformance and destructive peel and shear testing.

- Mr. Lichtenfels is very instrumental in the preparation of samples for permeability and strength testing.

Lawrence Wetzel
Project Coordinator

Background

Mr. Wetzel joined Geotechnics in 1995 as a Project Coordinator. In that position, he has gained hands on experience in the laboratory for compliance testing of seams and sheet samples of geosynthetic materials. Familiar with a wide range of geosynthetic materials including textured HDPE, VLDPE, PVC, Hypalon and geonet/geotextile composites. Mr. Wetzel also performs the data reduction along with report preparation and client discussions.

Education

BS Degree, Environmental Geology, University of Pittsburgh, Pittsburgh, Pennsylvania
Seventh Annual Great Lakes Geotechnical & Geoenvironmental Conference
Specialty Construction Techniques in Geotechnical & Environmental Applications
Microsoft "Access" Database Design Course
OSHA 24 Hour Haz-Wop Training

Experience

A selected list of Mr. Wetzel's experience is listed below:

- Mr. Wetzel is responsible for the operation of our geoenvironmental services, which includes material stabilization, chemical compatibility, slurry wall testing and classification testing of impacted materials.

- Mr. Wetzel is experienced in conformance testing of geosynthetic materials along with utilizing his chemical background to review and conform to the new EPA 9090 requirements.

- Mr. Wetzel is involved in coordinating with the Pennsylvania Department of Environmental Protection the new EPA 9090 requirements and testing.

- Mr. Wetzel is experienced in the processing of geosynthetic materials including sample preparation, specimen die cutting, conformance testing and destructive peel and shear testing. Mr. Wetzel is also responsible for the data reduction and report preparation.

- Mr. Wetzel is responsible for the rock testing which includes unconfined compression, soundness, and point load and slake durability testing.

Michael P. Smith
Project Coordinator

Background

Mr. Smith joined Geotechnics in 2000 as a Project Coordinator for the Raleigh, North Carolina Facility. Prior to joining Geotechnics, Mr. Smith was with Van Der Horst Geotechnical Engineering P.C. since 1997 as a Senior Engineering Technician. In that position, he has gained extensive hands on experience in the laboratory for general classification testing, along with compaction and flex-wall permeability testing. Mr. Smith also has extensive construction monitoring experience on typical geotechnical foundation projects and landfill construction. Mr. Smith also performs the data reduction along with report preparation and client discussions.

Education

BS, Environmental Science, Northland College, Ashland, Wisconsin
Emphasis: Biology & Geology, Chemistry and Environmental Geology

AS, Liberal Arts, Corning Community College, Corning, New York
Emphasis: Math and Science

Certifications

North Carolina DOT, Nuclear Testing Equipment

Experience

- Extensive experience performing general soil classification testing along with compaction testing. Also experienced performing flex-wall permeability testing. Very familiar with the ASTM standards for laboratory and in-field testing practices.

- Supervising all quality control field testing for various large scale construction projects. In addition, organizing and producing the final project reports in regard to the plans and project specifications.

- Mr. Smith was responsible for the quality control of the closing of several landfills in the Carolinas. He supervised the on-site testing that involved compaction testing and liner installation. Mr. Smith also prepared the final report.

- Conducted in-house training for testing procedures and safety seminars at Van Der Horst.

- Mr. Smith supervised the construction of a 23-acre landfill expansion in North, Carolina. The construction involved the placement of a HDPE liner and a compacted clay liner. Mr. Smith also prepared the final report.

Additional Work Experience

- Mr. Smith was a Technician with Corning, Inc. and performed testing and troubleshooting fiberoptic laser amplification modules.

- Mr. Smith was also a Technician for Aquaculture and performed water quality testing and effluent monitoring.

James Moyer
Project Coordinator

Background

Mr. Moyer joined Geotechnics in 1985 as a soils technician and has since been promoted to a Projected Coordinator. In that position, he has gained extensive experience in soil classification testing as well as compaction, permeability and Triaxial Strength Testing.

Education

A.S. Studies, Civil Engineering, Community College of Allegheny County
Certificate of Completion, Hydraulic Conductivity and Triaxial Shear Testing
24 Hour Hazardous Waste Training
Short Course, Visual Basic, Community College of Allegheny County

Experience and Background

Since joining Geotechnics, Mr. Moyer has gained extensive experience in the performance of classification, strength and permeability testing. Mr. Moyer is also responsible for the majority of data reduction and report preparation A selected list of Mr. Moyer's experience follows:

- Mr. Moyer has conducted over a thousand flex wall constant head permeability tests on clayey soils for the use of liners in various sanitary and residual landfills throughout the United States.

- He has also performed hundreds of strength related tests, including undrained triaxial tests with pore pressure measurements, undrained unconsolidated compression tests and unconfined compression tests on numerous geotechnical projects.

- Mr. Moyer was responsible for performing flex-wall permeability tests on numerous site materials such as paper sludge, coal refuse, fly ash and other industrial byproducts.

- Mr. Moyer also has experience performing flex-wall permeability tests on 12-inch diameter samples.

- He has experience in the preparation of bentonite slurry wall samples for short and long-term permeability with and without site leachates for numerous projects throughout the United States.

- He has performed strength testing on soil and cement grout mixtures for material stabilization.

Anthony Miglio
Project Coordinator

Background

Mr. Miglio joined Geotechnics in 1989 as a laboratory technician and has since been promoted to a Project Coordinator. He has gained extensive experience in soil classification and strength testing as well as compaction, permeability. Mr. Miglio is responsible for the direct shear and consolidation testing and has extensive experience testing numerous types of soils from around the country. In addition to the routine testing, he is very familiar with our data acquisition systems and is responsible for their upgrade and maintenance.

Education

B. S. Studies, Civil Engineering, Community College of Allegheny County
OSHA 40-Hour Hazardous Waste Training

Experience and Background

Mr. Miglio is very experienced in classification, compaction and strength testing of soils. Mr. Miglio is also very familiar with specialty aggregate testing for permeability and geosynthetic testing of various materials. Mr. Miglio also has the responsibility of communicating with the clients in regard to testing specifications and schedules. A selected list of Mr. Miglio's experience follows:

- Mr. Miglio is very instrumental in the preparation and remolding of very soft and sensitive samples for consolidation and direct shear testing.
- He is very experienced in soil classification, compaction and strength testing.
- He is very experienced in permeability testing of large aggregates, tree bark, tire chips and other materials utilized for drainage purposes.
- In addition to working with typical soils, Mr. Miglio has extensive experience working with residual wastes such as coal refuse, fly ash, and numerous industrial byproducts.
- Mr. Miglio has conducted soil classification and bentonite slurry evaluation on site for a major slurry trench project. He spent over 4 months in the field performing various tests for the client.
- Mr. Miglio performed in-plant sampling for a synthetic liner material manufacturer in New England. The sampling required documentation and testing coordinating.

Jamie R. Bard
Laboratory Technician

Background

Mr. Bard joined Geotechnics in 1992 and has been involved with the geosynthetics industry since 1989. Mr. Bard has gained extensive experience in performing geosynthetic conformance and destructive peel and shear testing.

Experience

A selected list of Mr. Bard's experience is listed below:

- Mr. Bard is responsible for compliance testing of seams and sheet samples of geosynthetic materials. He qualified to perform every test provided by the geosynthetic testing laboratory including carbon black dispersion evaluations and interface friction testing.

- Mr. Bard is also familiar with a wide range of geosynthetic materials including textured HDPE, VLDPE, PVC, Hypalon and geonet/geotextile composites.

- Mr. Bard is responsible for performing internal reference material testing prescribed by the laboratory quality assurance program and assists with the training and supervision of new technicians.

- He was responsible for seam and conformance testing of geosynthetic materials and for execution of chemical compatibility testing programs. Prepared and evaluated HDPE sheet and seam welds using microtome method.

- Participated in an extensive sampling and testing program at a major manufacturer's plant, securing conformance samples and performing preliminary compliance testing. Assisted with the design and fabrication of a leachate generation system for chemical compatibility immersion studies.

- Supervised production operations, conducted routine equipment maintenance and acted as safety officer for the plant. Conducted production quality control inspections. Directed the introduction of new products from laboratory scale through production. Knowledge of plastic production equipment and processes including extruders, compounders, and blow molders.

Robert Finlay
Laboratory Technician

Background

Mr. Finlay joined Geotechnics in 1996 following eleven years of laboratory service with IT Corporation. Mr. Finlay has been involved with the laboratory industry since 1985. Mr. Finlay has gained extensive experience in performing soils classification testing along with permeability and strength testing.

Experience

A selected list of Mr. Finlay's experience is listed below:

- Mr. Finlay has extensive experience performing soils classification testing consisting of Atterberg Limits, Moisture/Density Relationship, Grainsize, Moisture Contents, Hydrometers and Specific Gravity.
- Mr. Finlay also has extensive experience performing interface friction testing on our 12 inch Direct Shear Testing machine.
- Mr. Finlay also has experience for compliance testing of seams and sheet samples of geosynthetic materials. He is also qualified to perform numerous tests in the geosynthetic-testing laboratory including carbon black dispersion evaluations, Apparent Opening Size, Density Column and Thickness.
- Mr. Finlay has extensive experience performing conformance testing on numerous geosynthetic materials.
- Mr. Finlay is also experienced in running Transmissivity and Permativity testing.

John Petrovay
Laboratory Technician

Background

Mr. Petrovay joined Geotechnics in 1990 as a Laboratory Technician and has gained extensive experience in performing soils classification testing along with the testing of unique soil materials for various testing procedures.

Experience

A selected list of Mr. Petrovay's experience is listed below:

- Mr. Petrovay has over ten years of extensive experience performing soils classification testing consisting of Atterberg Limits, Grainsize Analysis, Moisture Contents, Hydrometers and Specific Gravity.

- Mr. Petrovay also has extensive experience performing Standard and Modified Proctors along with California Bearing Ratio (CBR) testing.

- In addition to testing Mr. Petrovay assists in the calibration of certain equipment.

Glen Ustazewski
Laboratory Technician

Background

Mr. Ustazewski joined Geotechnics in 1996 following ten years of laboratory service with IT Corporation. Mr. Ustazewski has been involved with the laboratory industry since 1986. Mr. Ustazewski has gained extensive experience in performing soils classification testing along with permeability and strength testing.

Experience

A selected list of Mr. Ustazewski's experience is listed below:

- Mr. Ustazewski has extensive experience performing soils classification testing consisting of Atterberg Limits, Moisture/Density Relationship, Grainsize, Moisture Contents, Hydrometers and Specific Gravity.

- Mr. Ustazewski also has experience performing flex-wall permeability tests along with strength testing including Direct Shear Testing.

- Mr. Ustazewski is responsible for performing permeability tests on various construction materials such as aggregates, sand, gravel and paper sludge and tire chips. Other tests include Loss on Ignition and other unique tests.

- Mr. Ustazewski also has experience for compliance testing of seams and sheet samples of geosynthetic materials. He is also qualified to perform numerous tests in the geosynthetic-testing laboratory including carbon black dispersion evaluations, Apparent Opening Size, Density Column and Thickness.

- Mr. Ustazewski is also experienced in running Transmissivity and Permativity testing.

APPENDIX C

GEOTECHNICS' ACCREDITATIONS

Effective Date: September 1, 2000
Expiration Date: August 31, 2001

American Association of State Highway and Transportation Officials

AASHTO Accreditation Program - Certificate of Accreditation

This is to signify that

Geotechnics, Inc.

East Pittsburgh, Pennsylvania

has demonstrated proficiency in the tests listed below and has met the minimum requirements in AASHTO R18 set forth by the AASHTO Highway Subcommittee on Materials for the testing of:

SOIL
T236 - D422 D427 D698 D854 D1557 D1883 D2166 D2216 D2434 D2435 D2850 D3080 D3740 D4318 D4767 D5084

AGGREGATE
C136

Executive Director

Chair, AASHTO
Highway Subcommittee on Materials

AASHTO R18

00-617

This certificate may not reflect the current accreditation status. The most current information can be obtained by contacting AMRL.

Accreditation number:
GAI-LAP - 14 - 96

TEL (610) 522-8440

Geosynthetic Institute
475 Kedron, Ave.
Folsom, PA 19033

Geotechnics Inc.

is granted accreditation

for designated geosynthetic test methods in accordance with the

Geosynthetic Accreditation Institute - Laboratory Accreditation Program (GAI-LAP)

as published in its annual directory.

This accreditation is valid until June 30, 2001.

Robert M. Koerner, Ph.D., P.E.
Director

George R. Koerner, Ph.D., P.E. & CQA
Auditor

©GOLES/4

DEPARTMENT OF THE ARMY
WATERWAYS EXPERIMENT STATION, CORPS OF ENGINEERS
3909 HALLS FERRY ROAD
VICKSBURG, MISSISSIPPI 39180-6199

REPLY TO
ATTENTION OF

February 5, 1999

Geotechnical Laboratory

Mr. Kevin Lichtenfels
Quality Assurance Manager
Geotechnics, Inc.
544 Braddock Avenue
East Pittsburgh, Pennsylvania 15112

Subject: Lab Validation

Dear Mr. Lichtenfels:

We have received your letter and attachments dated January 22, 1999 describing the steps you have taken to correct deficiencies we cited in our inspection report dated December 21, 1998. We find that all deficiencies have been satisfactorily corrected. Your laboratory is qualified for two (2) years from the date of the inspection, December 2, 1998, to conduct tests covered by our inspection.

We will add your laboratory to the list of commercial laboratories qualified to conduct material tests, addressed by the inspection, for the U.S. Army Corps of Engineers. All Corps offices will be notified of this decision and will have the opportunity to use your services.

Sincerely,

for Daniel R. Lowell

Robert D. Bennett
Director, Materials Testing Center

DEPARTMENT OF THE ARMY
PITTSBURGH DISTRICT, CORPS OF ENGINEERS
WILLIAM S. MOORHEAD FEDERAL BUILDING
1000 LIBERTY AVENUE
PITTSBURGH, PA 15222-4186

REPLY TO
ATTENTION OF

February 22, 1999

Mr. Randy O'Rourke
Geotechnics
544 Braddock Avenue
East Pittsburgh, PA 15112

Mr. O'Rourke:

The inspection of your laboratory facility was conducted by the U.S. Army Waterways Experiment Station (WES). The final report of this inspection, dated December 21, 1998, was provided to you. The validation inspection by WES Staff was very thorough and more detailed than prior lab audits. Your lab was found to meet all Corps requirements.

The inspection is good for two years, after which another inspection will be required if continued government work is to be expected. Normally the district requiring your facilities for testing will contact our lab to perform the inspection. When the end of the two years approaches feel free to remind the district of the impending end to your certification.

Sincerely,

Brian H. Greene

Brian H. Greene, P.G.
Chief, Geology Section

Printed on Recycled Paper

Geotechnics

APPENDIX D

LABORATORY CAPABILITIES

Geotechnics

Laboratory Capabilities

Geotechnical Testing

Classification Testing

Test Description	Test Method
Visual Description	ASTM D-2487
Water Content	ASTM D-2216
Sieve Analysis	ASTM D-422
Hydrometer Analysis	ASTM D-422
Percent passing #200	ASTM D-1140
Multi Point Atterberg Limits	ASTM D-4318
1-Point Atterberg Limit	ASTM D-4318
Non-Plastic Limit	ASTM D-4318
Shrinkage Limit	ASTM D-427
Specific Gravity	ASTM D-854
Loss On Ignition	ASTM D-2974
Porosity (Unit Weight & Specific Gravity)	ASTM D-854/D-2937
Water Holding Capacity	ASTM D2980
Soil Fertility	Penn State

Density Tests

Test Description	Test Method
Standard Proctor	ASTM D-698
Modified Proctor	ASTM D-1557
12" Diameter Standard Proctor	U.S. Army Corps
One Point Proctor	ASTM D-698,D-1557
Relative Density Using Vibratory Table	ASTM D-4253,D-4254
Maximum Density	Modified
Minimum Density	ASTM D-4254
Bulk Density Of Shelby Tubes	ASTM D-2937

Permeability

Test Description	Test Method
3" Diameter Flex Wall Permeability (undisturbed)	ASTM D-5084
3" Diameter Flex Wall Permeability (remolded)	ASTM D-5084
Permometer-3" Diameter Flex Wall Permeability (undisturbed)	ASTM D-5084
Permometer-3" Diameter Flex Wall Permeability (remolded)	ASTM D-5084
4" Diameter Flex Wall Permeability (remolded)	ASTM D-5084
4" Diameter Flex Wall Permeability (GCL)	ASTM D-5084
Long Term Permeability (Weekly Rate)	ASTM D-5084
Leachate Compatability (Weekly Rate)	ASTM D-5084
Pin Hole Dispersion	ASTM D4647
12" Inch Flex Wall Permeability (remolded)	ASTM D-5084
4" Diameter Rigid Wall Permeability On Sands	ASTM D-2434
6-12 Inch Diameter Rigid Wall Permeability On Aggregates	ASTM D-2434
6-12 Inch Diameter Rigid Wall Permeability On Aggregates (3-Loads)	ASTM D-2434

Geotechnics

Strength Testing

Test Description	Test Method
Pocket Penetrometer	Method 130.2
California Bearing Ratio (CBR), 1 Point	ASTM D-1883
California Bearing Ratio (CBR), 3 Points	ASTM D-1883
Unconfined Compression (undisturbed)	ASTM D2166
Unconfined Compression (remolded)	ASTM D2166
Peak Direct Shear (3 points, undisturbed) (2.5" Shear Box)	ASTM D-3080
Peak Direct Shear (3 points, remolded) (2.5" Shear Box)	ASTM D-3080
Residual Direct Shear (3 points, undisturbed) (2.5" Shear Box)	
Residual Direct Shear (3 points, remolded) (2.5" Shear Box)	
Peak Direct Shear (3 points, remolded) (12" Shear Box)	ASTM D-3080
Unconsolidated Undrained Triaxial - UU (undisturbed one point)	ASTM D-2850
Unconsolidated Undrained Triaxial - UU (remolded one point)	ASTM D-2850
Consolidated Undrained Triaxial with Pore Pressure Measurements (3 Pt Series undisturbed)	ASTM D-4767
Consolidated Undrained Triaxial with Pore Pressure Measurements (3 Pt Series remolded)	ASTM D-4767

Interface Friction by Direct Shear

Test Description	Test Method
Geosynthetic to Geosynthetic, (3 Points), 12" Direct Shear Box	ASTM D5321
Geosynthetic to Soils, (3 Points), 12" Direct Shear Box	ASTM D5321
Geosynthetic to GCL's, (3 Points), 12" Direct Shear Box	ASTM D6243
GCL's to Soils, (3 Points), 12" Direct Shear Box	ASTM D6243

Consolidation & Swell Potential Testing

Test Description	Test Method
One Dimensional Consolidation, 2 rebound curves, (2.5")	ASTM D-2435
Remolded One Dimensional Consolidation, 2 rebound curves, (2.5")	ASTM D-2435
One Dimensional Swell, (2.5")	ASTM D-4546
One Dimensional Settlement, (2.5")	ASTM D-4546
One Dimensional Settlement, Air Dry, (2.5")	ASTM D-4546
Expansion Index of Soils, Submerged (6" Dia.)	ASTM D-4829
Expansion Index of Soils, Under Load, Submerged (6" Dia.)	ASTM D-4829
Expansion Index of Soils, Under Load, Submerged, Heated (6" Dia.)	ASTM D-4829

PaDot Testing

Test Description	Test Method
Minimum Resistivity	PTM-133
Soil Chlorides	CAL DOT-422
Soil Sulfates	CAL DOT-417
Soil ph for Corrosion Testing	ASTM G51

Geotechnics

Aggregates

Test Description	Test Method
Sieve	ASTM C136
Insoluble Residue in Carbonate Aggregates	ASTM D-3042
Clay Lumps and Friable Particles in Aggregates	ASTM C-142
Angularity	ASTM D-2488
Relative Density Using Vibratory Table	ASTM D-4253,D-4254
Specific Gravity of Coarse Material	ASTM-C127
Specific Gravity of Fine Material	ASTM C-128
Soundness, Coarse Material	ASTM C-88
Soundness, Fine Material	ASTM C-88
LA Abrasion	

Rock & Grout Testing

Test Description	Test Method
Point Load	ASTM D 5731
Unconfined Compression	ASTM D 2938
Soundness, 5 Cycles	ASTM C88
Slake Durability, 2 Cycles	ASTM D4644
Unconfined Compression, Grout Cube or Cylinder	ASTM C-109
Grout Cube or Cylinder Preparation	ASTM C-109
Freeze Thaw, 60 Cycles	
Unconfined Compression on Concrete Cylinders	ASTM C-39

Geoenvironmental Testing

Bentonite Compatability and Slurry Wall Design

Test Description	Test Method
Backfill Slump & Slump Cone	ASTM C143
Density of Bentonite Slurry	ASTM D4380
Filter Cake Hydraulic Conductivity	EPA SLP #EX-03
Marsh Cone	EPA SLT #I-02
Free Swell of Bentonite	ASTM D5890
Confined Swell	GRI-GCL-1
Filtrate Loss	EPA SLP #I-04
Paint Filter	SW 846 #9095

Stabilization of Sludges

Test Description	Test Method
Pocket Penetrometer	Method 130.2
Strength of Stabilized Cubes	ASTM D2166
Filtrate Loss	EPA SLP# I-04
Paint Filter	Method 9095

Geotechnics

Geosynthetic Testing

Geomembranes

Test Description	Test Method
Peel and Shear	ASTM D4437
Thickness	D1593-D5199-D5994
Density	ASTM D792-D1505
Melt Flow Index	ASTM D1238
Carbon Black Content	ASTM D1603
Tear Resistance	ASTM D1004 Die C
Puncture Resistance	FTMS 101, 2065
Puncture Resistance	ASTM D4833
Tensile Properties	ASTM D638
PVC Tensiles	ASTM D882
Hypalon Tensiles	ASTM D751
Hypalon Ply Adhesion	ASTM D413
Volatile Loss	ASTM D1203
Dimensional Stability	ASTM D1204
Constant Load	ASTM D5397
Specific Gravity	ASTM D792

Geonets And Geocomposites

Test Description	Test Method
Mass per Unit Area	ASTM D3776
Thickness	ASTM D1777
Density	ASTM D1505-D792
Melt Index	ASTM D1238, Condition E
Carbon Black Content	ASTM D1603
Strip Tensile	ASTM D413
Strip Tensile	ASTM D5035
Transmissivity 1 Load, 1 Gradient	ASTM D4716
Transmissivity 1 Load, 3Gradients	ASTM D4716
Each Additional Load	ASTM D4716
Compression Behavior	ASTM D 1621
Ply Adhesion	ASTM D413
Ply Adhesion	ASTM D904

Geotextiles

Test Description	Test Method
Mass per Unit Area	ASTM D3776
Thickness	ASTM D1777
Grab Strength	ASTM D4632
Trapezoidal Tear	ASTM D4533
Puncture Resistance	ASTM D4833
Mullen Burst	ASTM D3786
Permittivity	ASTM D4491
Apparent Opening Size (AOS)	ASTM D4751
Wide Width, Typical Nonwovens	ASTM D4595
Wide Width, Wovens/High Strength, Roller Grips & Extensometer	ASTM D4595

Geotechnics

Geogrids

Test Description	Test Method
Mass per Unit Area	D3776
Rib or Junction Thickness	ASTM D374
Aperture Size, mmxmm	ASTM D374
Density	ASTM D1505-D792
Melt Index	ASTM D1238, Condition E
Carbon Black Content	ASTM D1603
Carbon Black Dispersion	ASTM D2663-D5596
Rib Strength, Uniaxial	GRI-GG-1
Rib Strength, Biaxial	GRI-GG-1
Junction Strength, Uniaxial	GRI-GG-2
Junction Strength, Biaxial	GRI-GG-2
Wide Width, Uniaxial	ASTM D4595 (Mod.)
Wide Width, Biaxial	ASTM D4595 (Mod.)

Geosynthetic Clay Liners

Test Description	Test Method
Bentonite Mass per Unit Area	D3776/D5261/D5993
Thickness	D1777/D5199
Swell Index	D5890
Internal Shear 1 Normal Stress	D6243
Index Flux or Permeability	D5887

In-Plant Sampling

Test Description	Test Method
Sampling At The Plant/ Per Hour	NA

Geotechnics

APPENDIX E

SAMPLE DATA

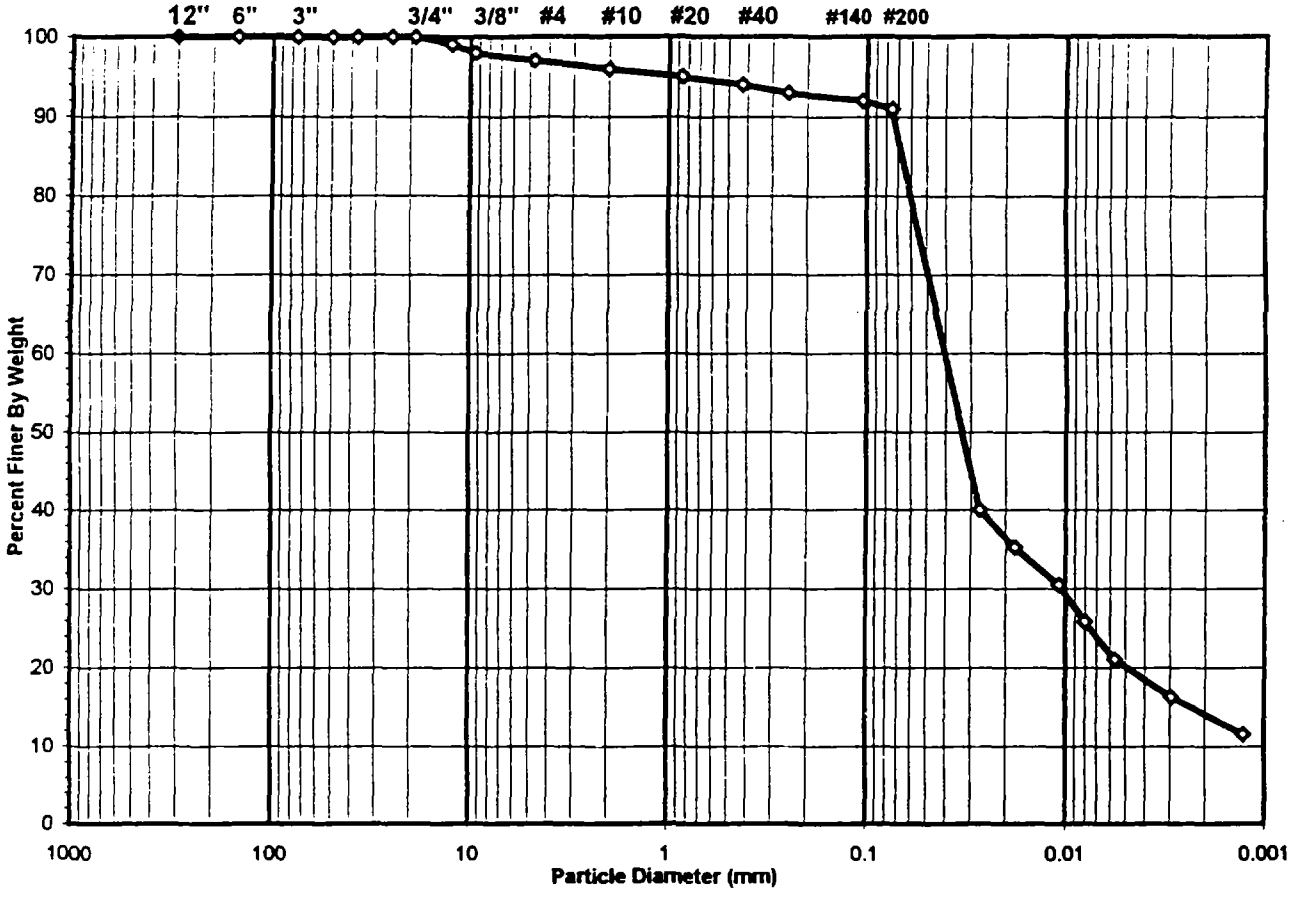
geotechnics

GEOTECHNICAL SAMPLE DATA

SIEVE AND HYDROMETER ANALYSIS
ASTM D 422-63 (SOP-S3)

Client	GEOTECHNICS	Boring No.	NA
Client Reference	QA-VERIFICATION	Depth (ft)	NA
Project No.	99000-01	Sample No.	NA
Lab ID	99000-01.001	Soil Color	**BROWN**

	SIEVE ANALYSIS			*HYDROMETER*	
USCS	cobbles	gravel	sand	silt and clay fraction	
USDA	cobbles	gravel	sand	silt	clay



USCS Summary		
Sieve Sizes (mm)		**Percentage**
Greater Than #4	*Gravel*	3.00
#4 To #200	*Sand*	6.00
Finer Than #200	*Silt & Clay*	91.00

USCS Symbol ***cl, ASSUMED***

USCS Classification ***LEAN CLAY***

DCN: CT-S3A DATE: 6-23-99 REVISION: 3

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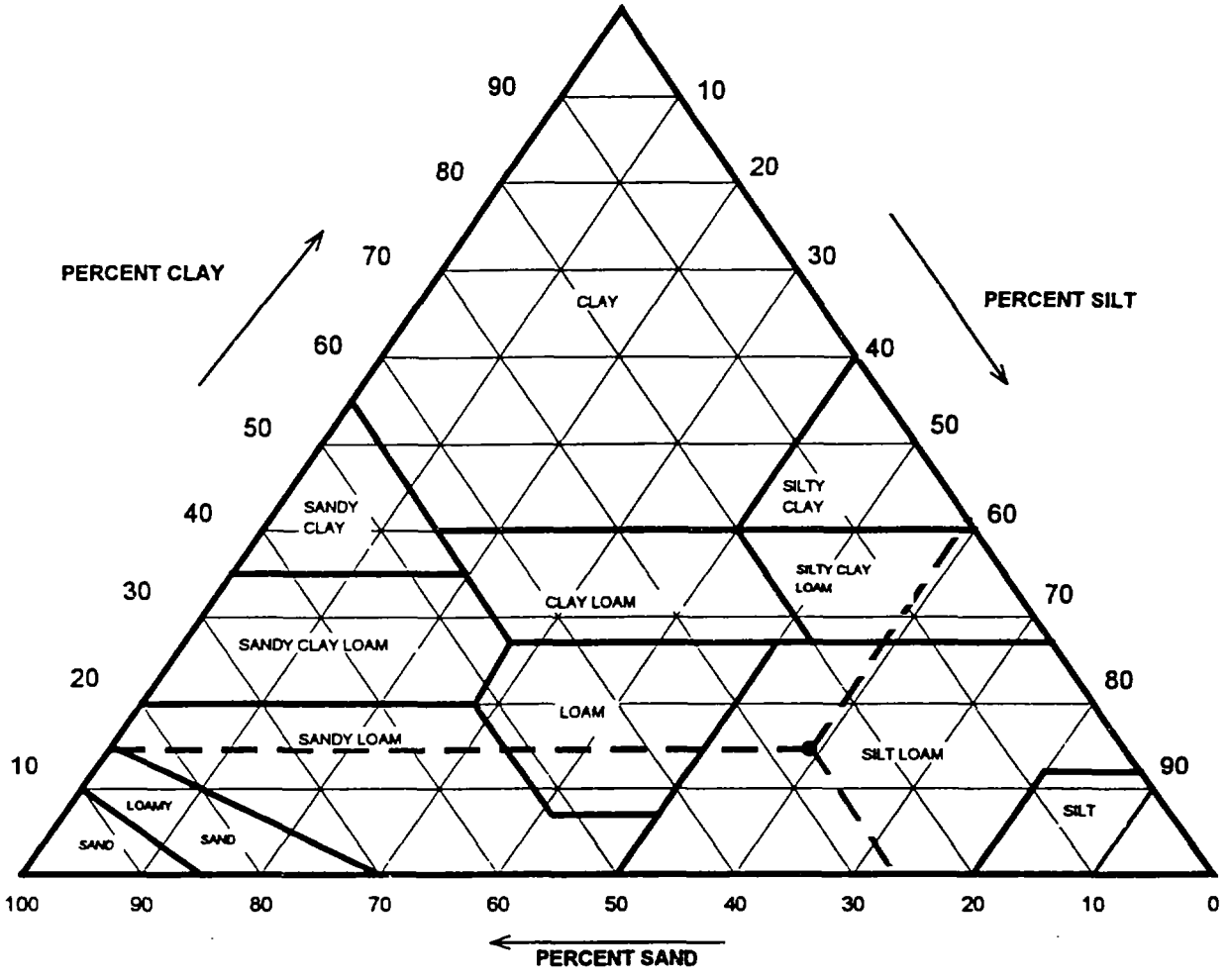
Geotechnics

USDA CLASSIFICATION CHART

Client	GEOTECHNICS	Boring No.	NA
Client Reference	QA-VERIFICATION	Depth (ft)	NA
Project No.	99000-01	Sample No.	NA
Lab ID	99000-01.001	Soil Color	BROWN



Particle Size (mm)	Percent Finer	USDA SUMMARY	Actual Percentage	Corrected % of Minus 2.0 mm material for USDA Classificat.
		Gravel	4.00	**0.00**
2	96.00	*Sand*	25.30	**26.35**
0.05	70.70	*Silt*	56.63	**58.98**
0.002	14.08	*Clay*	14.08	**14.66**

USDA Classification ***SILT LOAM***

Geotechnics

WASH SIEVE ANALYSIS

ASTM D 422-63 (SOP-S3)

Client	GEOTECHNICS	Boring No.	NA
Client Reference	QA-VERIFICATION	Depth (ft)	NA
Project No.	99000-01	Sample No.	NA
Lab ID	99000-01.001	Soil Color	**BROWN**

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	878	Tare No.	NA
Wgt.Tare + Wet Specimen (gm)	1500.00	Wgt.Tare + Wet Specimen (gm)	NA
Wgt.Tare + Dry Specimen (gm)	1400.00	Wgt.Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	400.00	Weight of Tare (gm)	NA
Weight of Water (gm)	100.00	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	1000.00	Weight of Dry Soil (gm)	NA
Moisture Content (%)	**10.0**	**Moisture Content (%)**	**NA**

Wet Weight -3/4" Sample (gm)	NA	Weight of the Dry Specimen (gm)	1000.00
Dry Weight - 3/4" Sample (gm)	90.00	Weight of minus #200 material (gm)	910.00
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	90.00
Dry Weight + 3/4" Sample (gm)	0.00		
Total Dry Weight Sample (gm)	NA		

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated **Percent Finer (%)**
12"	300	0.00	0.00	0.00	100.00	**100.00**
6"	150	0.00	0.00	0.00	100.00	**100.00**
3"	75	0.00	0.00	0.00	100.00	**100.00**
2"	50	0.00	0.00	0.00	100.00	**100.00**
1 1/2"	37.5	0.00	0.00	0.00	100.00	**100.00**
1"	25.0	0.00	0.00	0.00	100.00	**100.00**
3/4"	19.0	0.00	0.00	0.00	100.00	**100.00**
1/2"	12.5	10.00	1.00	1.00	99.00	**99.00**
3/8"	9.50	10.00	1.00	2.00	98.00	**98.00**
#4	4.75	10.00	1.00	3.00	97.00	**97.00**
#10	2.00	10.00	1.00	4.00	96.00	**96.00**
#20	0.85	10.00	1.00	5.00	95.00	**95.00**
#40	0.425	10.00	1.00	6.00	94.00	**94.00**
#60	0.250	10.00	1.00	7.00	93.00	**93.00**
#140	0.106	10.00	1.00	8.00	92.00	**92.00**
#200	0.075	10.00	1.00	9.00	91.00	**91.00**
Pan	-	910.00	91.00	100.00	-	-

Tested By JCM Date ######## Checked By Date

Geotechnics

HYDROMETER ANALYSIS

ASTM D 422-63 (SOP-S3)

Client	GEOTECHNICS	Boring No.	NA
Client Reference	QA-VERIFICATION	Depth (ft)	NA
Project No.	99000-01	Sample No.	NA
Lab ID	99000-01.001	Soil Color	**BROWN**

Elapsed Time (min)		R Measured	Temp. (°C)	R Corrected	N (%)	K Factor	Diameter (mm)	N' (%)
0	NA	NA	NA	NA	NA	NA	NA	NA
2	50.0	50.0	19.9	42.2	44.0	0.01346	0.0271	**40.0**
5		45.0	19.9	37.2	38.8	0.01346	0.0180	**35.3**
15		40.0	19.9	32.2	33.6	0.01346	0.0108	**30.5**
30		35.0	19.9	27.2	28.3	0.01346	0.0080	**25.8**
60		30.0	22.4	22.2	23.1	0.01307	0.0057	**21.0**
250		25.0	19.9	17.2	17.9	0.01346	0.0030	**16.3**
1440		20.0	19.9	12.2	12.7	0.01346	0.0013	**11.6**

Soil Specimen Data		Other Corrections	
Tare No.	1089		
Tare + Dry Material (gm)	150	a - Factor	0.99
Weight of Tare (gm)	50	Composite Correction	7.80
Weight of Deflocculant (gm)	5.0	Percent Finer than # 200	91.00
Weight of Dry Material (gm)	95		
		Specific Gravity	2.7 Assumed

Note: *Hydrometer test is performed on - # 200 sieve material.*

Tested By TO Date ######## Checked By Date

3 POINT ATTERBERG LIMIT

ASTM D 4318-96 (SOP - S4)

Client	GEOTECHNICS	Boring No.	NA
Client Reference	QA - VERIFICATION	Depth (ft)	NA
Project No.	98000-01	Sample No.	NA
Lab ID	98000-01.001	Soil Description	**BROWN SILT**

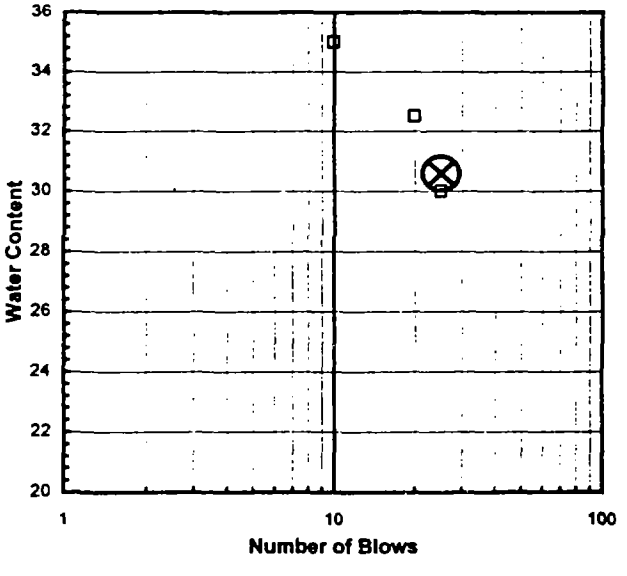
Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description. (Minus No. 40 sieve material, Airdried)

Liquid Limit Test	**1**	**2**	**3**	
				M
Tare Number	1605	1500	1706	**U**
Wt. of Tare & WS (gm)	104.00	103.00	102.00	**L**
Wt. of Tare & DS (gm)	90.00	90.00	90.00	**T**
Wt. of Tare (gm)	50.00	50.00	50.00	**I**
Wt. of Water (gm)	14.0	13.0	12.0	**P**
Wt. of DS (gm)	40.0	40.0	40.0	**O**
				I
Moisture Content (%)	**35.0**	**32.5**	**30.0**	**N**
Number of Blows	**10**	**20**	**25**	**T**

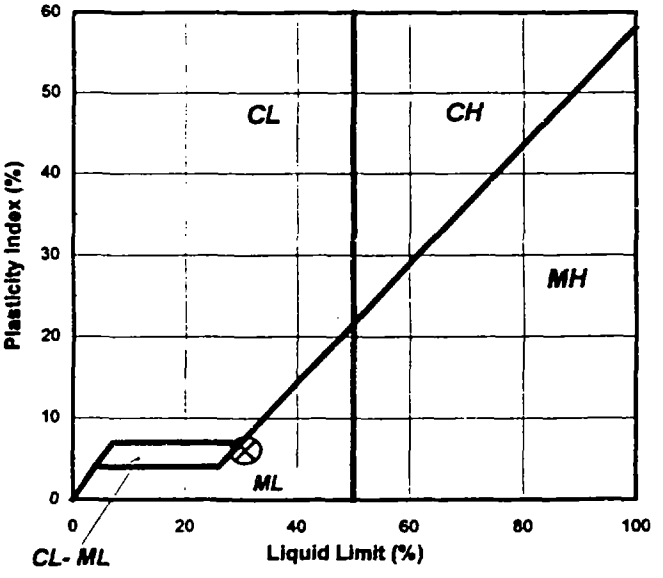
Plastic Limit Test	**1**	**2**	**3**
Tare Number	1850	2222	1541
Wt. of Tare & WS (gm)	100.00	100.00	100.00
Wt. of Tare & DS (gm)	90.00	90.00	90.00
Wt. of Tare (gm)	50.00	50.00	50.00
Wt. of Water (gm)	10.0	10.0	10.0
Wt. of DS (gm)	40.0	40.0	40.0
Moisture Content (%)	**25.0**	**25.0**	**25.0**

Test Results	
Liquid Limit (%)	**31**
Plastic Limit (%)	**25**
Plasticity Index (%)	**6**
USCS Symbol	**ML**

Flow Curve



Plasticity Chart



Tested By KBL *Date* ######### *Checked By* *Date*

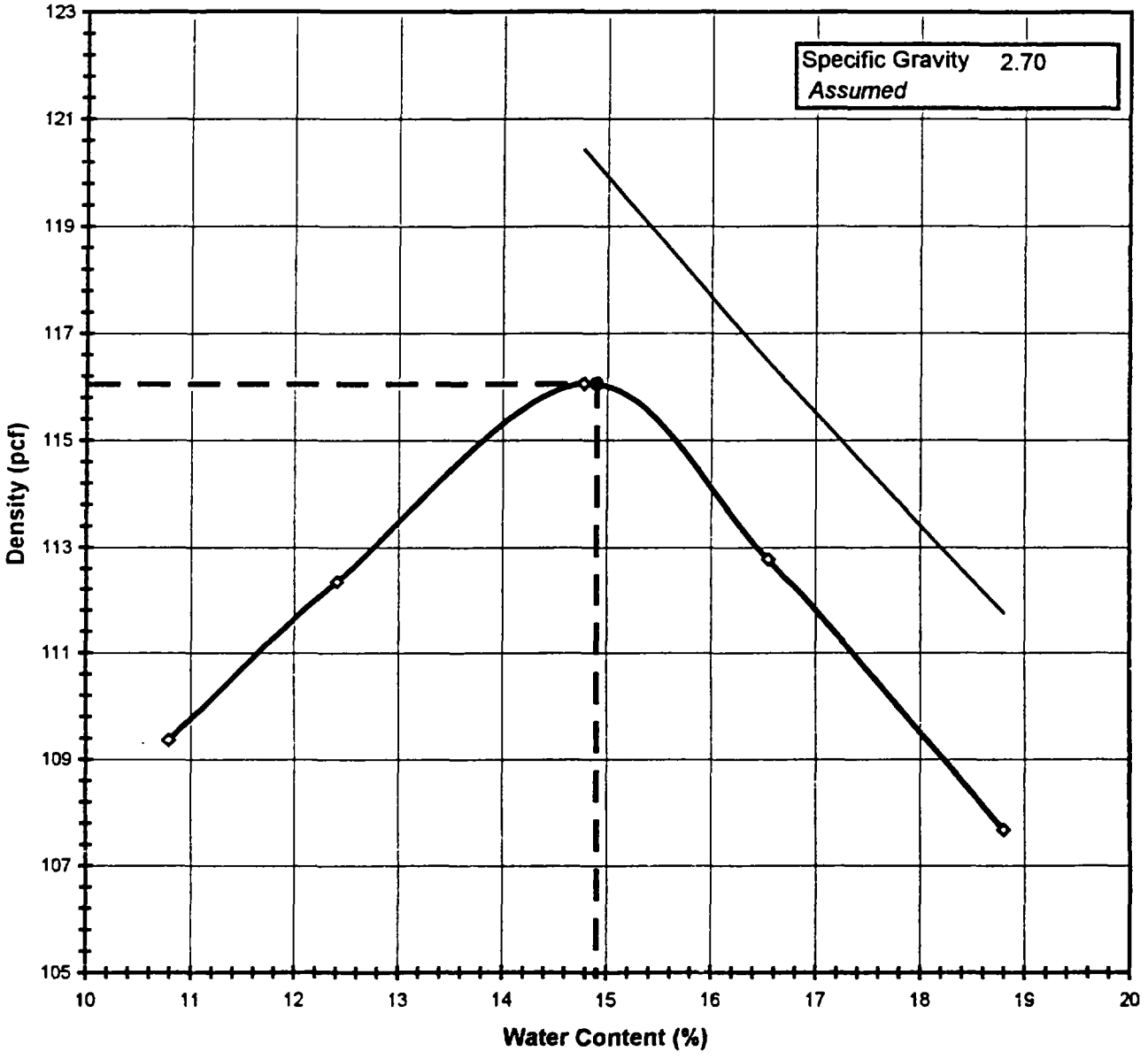
MOISTURE DENSITY RELATIONSHIP

ASTM D698-91 SOP-S12

Client	GEOTECHNICS	Boring No.	NA
Client Reference	QA - VERIFICATION	Depth (ft)	NA
Project No.	98000-01	Sample No.	NA
Lab ID	98000-01.001	Test Method	**STANDARD**

Visual Description BROWN CLAY AND ROCK FRAGMENTS

Optimum Water Content **14.9**
Maximum Dry Density **116.1**



Tested By *JCM* *Date* *06/25/1998* *Checked By* *Date*

DCN:CT-S12 DATE: 6-25-98 REVISION 3

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Geotechnics

MOISTURE - DENSITY RELATIONSHIP

ASTM D698-91 SOP-S12

Client	GEOTECHNICS	Boring No.	NA
Client Reference	QA - VERIFICATION	Depth (ft)	NA
Project No.	98000-01	Sample No.	NA
Lab ID	98000-01.001		

Visual Description: BROWN CLAY AND ROCK FRAGMENTS

Total Weight of the Sample (gm)	NA
As Received Water Content(%)	NA
Assumed Specific Gravity	2.70
Percent Retained on 3/4"	NA
Percent Retained on 3/8"	NA
Percent Retained on #4	NA
Oversize Material	Not included
Procedure Used	C

TestType	STANDARD
Rammer Weight (lbs)	5.5
Rammer Drop (in)	12
Rammer Type	MECHANICAL
Machine ID	G441
Mold ID	NA
Mold diameter	6"
Weight of the Mold	6126
Volume of the Mold(cc)	2124

Mold / Specimen

Point No.	1	2	3	4	5
Wt. of Mold & WS (gm)	10250	10425	10660	10600	10480
Wt.of Mold (gm)	6126	6126	6126	6126	6126
Wt. of WS	4124	4299	4534	4474	4354
Mold Volume (cc)	2124	2124	2124	2124	2124

Moisture Content / Density

Tare Number	1615	1673	1650	1635	1075
Wt. of Tare & WS (gm)	367.00	304.60	339.28	354.60	323.60
Wt. of Tare & DS (gm)	341.18	282.21	308.82	318.75	289.32
Wt. of Tare (gm)	101.80	101.80	102.71	102.10	107.00
Wt. of Water (gm)	25.82	22.39	30.46	35.85	34.28
Wt. of DS (gm)	239.38	180.41	206.11	216.65	182.32

Wet Density (gm/cc)	1.94	2.02	2.13	2.11	2.05
Wet Density (pcf)	121.2	126.3	133.2	131.4	127.9
Moisture Content (%)	**10.8**	**12.4**	**14.8**	**16.5**	**18.8**
Dry Density (pcf)	**109.4**	**112.4**	**116.1**	**112.8**	**107.7**

Zero Air Voids

Moisture Content (%)	14.8	16.5	18.8
Dry Unit Weight (pcf)	120.4	116.5	111.7

Tested By JCM *Date* 06/25/1998 *Checked By* *Date*

DCN:CT-S12 DATE: 6-25-98 REVISION 3

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Geotechnics

SPECIFIC GRAVITY

ASTM D 854-92 (SOP - S5)

Client	GEOTECHNICS	Boring No.	NA
Client Reference	QA-VERIFICATION	Depth (ft)	NA
Project No.	98000-00	Sample No.	GEO SAMPLE
Lab ID	*98000-00.000*	*Visual Description*	***BROWN CLAY***
			(Minus No.4 sieve material, airdried)

Replicate Number	**1**	**2**
Pycnometer ID	G 449	G 449
Weight of Pycnometer + Soil + Water (gm)	699.94	699.94
Temperature, T (°Celsius)	22.5	22.5
Weight of Pycnometer + Water (gm)	683.80	683.80
Tare Number	1135	1200
Weight of Tare + Dry Soil (gm)	150.21	150.21
Weight of Tare (gm)	101.32	101.32
Weight of Dry Soil (gm)	48.89	48.89
Specific Gravity of Soil @ T	1.493	1.493
Specific Gravity of Water @ T	0.9977	0.9977
Conversion Factor for Temperature T	0.9995	0.9995
Specific Gravity @ 20° Celsius	1.494	1.494

Average Specific Gravity @ 20° Celsius	1.49

Tested By *KBL* *Date* ####### *Checked By* *Date*

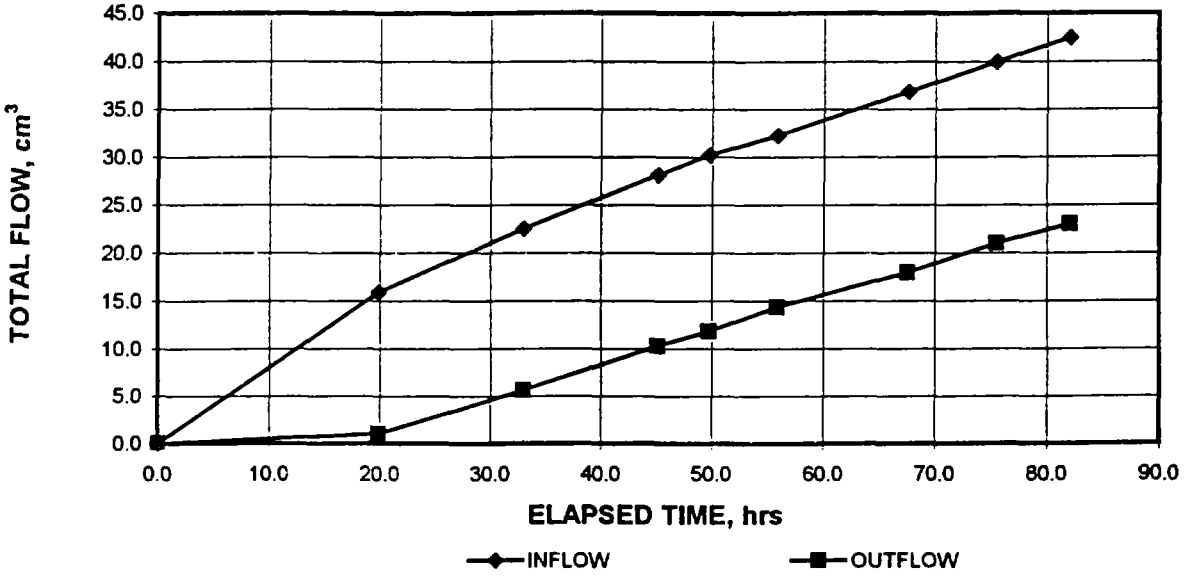
PERMEABILITY TEST

ASTM D 5084-90(Reapproved 1997)
(SOP-S22A & S22B)

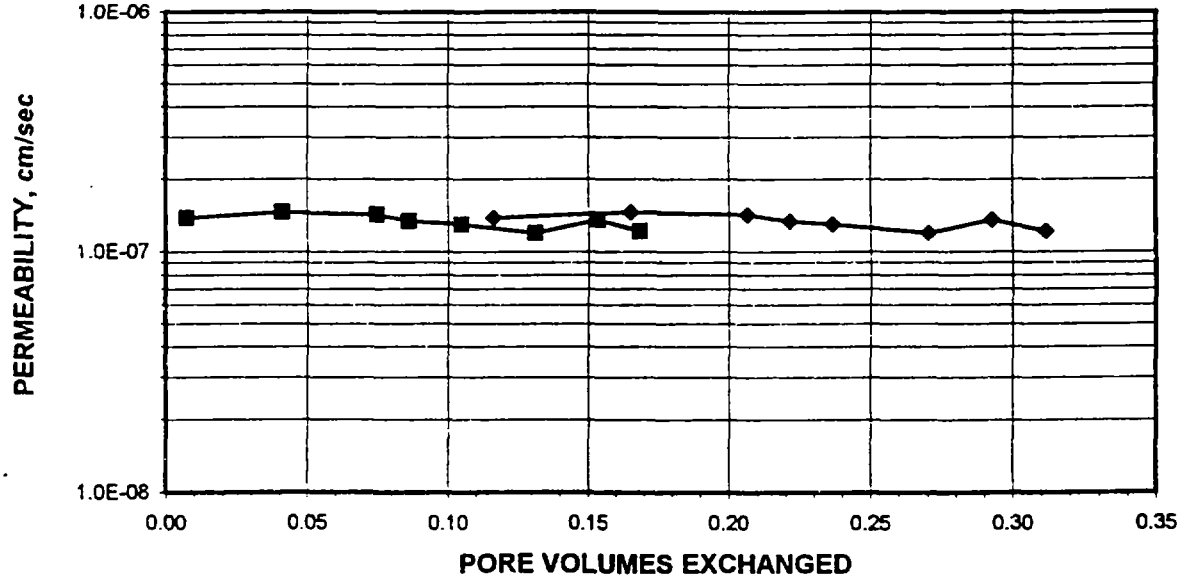
Client	GEOTECHNICS	Boring No.	NA
Client Project	QA-VERIFICATION	Depth (ft.)	NA
Project No.	99000-00	Sample No.	NA
Lab ID No.	99000-00.000		

AVERAGE PERMEABILITY = 1.3E-07 cm/sec @ 20°C
AVERAGE PERMEABILITY = 1.3E-09 m/sec @ 20°C

TOTAL FLOW vs. ELAPSED TIME



PORE VOLUMES EXCHANGED vs. PERMEABILITY



Tested By: JCM Date: 06/21/1998 Checked By: Date:

DCN: CT-22C DATE: 01-11-99 REVISION:3 \\Wtserver1\share\1998\982862\SOQ\[PERM9.XLS]Sheet1

PERMEABILITY TEST

ASTM D 5084-90(Reapproved 1997)
(SOP-S22A & S22B)

Client	GEOTECHNICS	Boring No.	NA
Client Project	QA-VERIFICATION	Depth (ft.)	NA
Project No.	99000-00	Sample No.	NA
Lab ID No.	99000-00.000		
		Specific Gravity	2.70 Assumed
		Sample Condition	Remolded

Visual Description: BROWN CLAY

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
Tare Number	579	579
Wt. of Tare & WS (gm.)	368.72	368.72
Wt. of Tare & DS (gm.)	335.81	335.81
Wt. of Tare (gm.)	84.02	84.02
Wt. of Water (gm.)	32.91	32.91
Wt. of DS (gm.)	251.79	251.79
Moisture Content (%)	**13.1**	**13.1**

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of Tube & WS (gm.)	2230.60	NA
Wt. of Tube (gm.)	1352.50	NA
Wt. of WS (gm.)	878.10	878.10
Length 1 (in.)	4.000	4.000
Length 2 (in.)	4.000	4.000
Length 3 (in.)	4.000	4.000
Top Diameter (in.)	2.870	2.870
Middle Diameter (in.)	2.870	2.870
Bottom Diameter (in.)	2.870	2.870
Average Length (in.)	4.00	4.00
Average Area (in.^{2})	6.47	6.47
Sample Volume (cm^3)	423.94	423.94
Unit Wet Wt. (gm./ cm^3)	2.07	2.07
Unit Wet Wt. (pcf)	129.3	129.3
Unit Dry Wt. (pcf)	114.3	114.3
Unit Dry Wt. (gm./ cm^3)	1.83	1.83
Void Ratio, e	0.47	0.47
Porosity, n	0.32	0.32
Pore Volume (cm^3)	136.3	136.3

Tested By: JCM Date: 06/21/1998 Checked By: Date:

PERMEABILITY TEST

ASTM D 5084-90(Reapproved 1997)
(SOP-S22A & S22B)

Client	GEOTECHNICS	Boring No.	NA
Client Project	QA-VERIFICATION	Depth (ft.)	NA
Project No.	99000-00	Sample No.	NA
Lab ID No.	99000-00.000		

Pressure Heads (Constant)	
Top Cap (psi)	27.5
Bottom Cap (psi)	30.0
Cell (psi)	35.0
Total Pressure Head (cm)	175.8

Final Sample Dimensions	
Sample Length (cm), L	10.16
Sample Diameter (cm)	7.29
Sample Area (cm^2), A	41.73
Inflow Burette Area (cm^2), a-in	4.482
Outflow Burette Area (cm^2), a-out	4.478
B Parameter (%)	100

AVERAGE PERMEABILITY = 1.3E-07 cm/sec @ 20°C
AVERAGE PERMEABILITY = 1.3E-09 m/sec @ 20°C

DATE	TIME		ELAPSED TIME t	TOTAL INFLOW	TOTAL OUTFLOW	TOTAL HEAD h	FLOW (0 flow)	TEMP.	INCREMENTAL PERMEABILITY @ 20°C
(mm/dd/yy)	(hr)	(min)	(hr)	(cm^3)	(cm^3)	(cm)	(1 stop)	(°C)	(cm/sec)
06/21/1998	11	40	0.0	0.0	0.0	195.2	0	23.0	NA
06/22/1998	7	35	19.9	15.9	1.0	191.4	0	23.0	1.4E-07
06/22/1998	20	40	33.0	22.5	5.6	188.9	0	22.0	1.5E-07
06/23/1998	8	50	45.2	28.1	10.2	186.6	0	22.5	1.4E-07
06/23/1998	13	25	49.8	30.2	11.8	185.8	0	22.5	1.3E-07
06/23/1998	19	30	55.8	32.2	14.3	184.8	0	22.5	1.3E-07
06/24/1998	7	15	67.6	36.8	17.9	183.0	0	23.0	1.2E-07
06/24/1998	15	10	75.5	39.9	21.0	181.6	0	22.5	1.4E-07
06/24/1998	21	45	82.1	42.5	23.0	180.6	1	23.0	1.2E-07

Tested By: JCM Date: 06/21/1998 Checked By: Date:

DCN	CT-S21
DATE	02/17/00
REVISION	3

DIRECT SHEAR

ASTM D 3080-90 (SOP-S21)

Client	GEOTECHNICS	Boring No.	NA
Client Reference	GEOTEST TEMPLATE	Depth (ft)	NA
Project No.	00000-01	Sample No.	NA
Lab ID	00000.001	Visual Description	BROWN CLAY

Sample Conditions: REMOLDED, INUNDATED AND DOUBLE DRAINED

Maximum Shear Stress		Normal Stress
6.49	(1)	**5**
11.12	(2)	**11.97**
15.94	(3)	**20**

Overall Regression Analysis

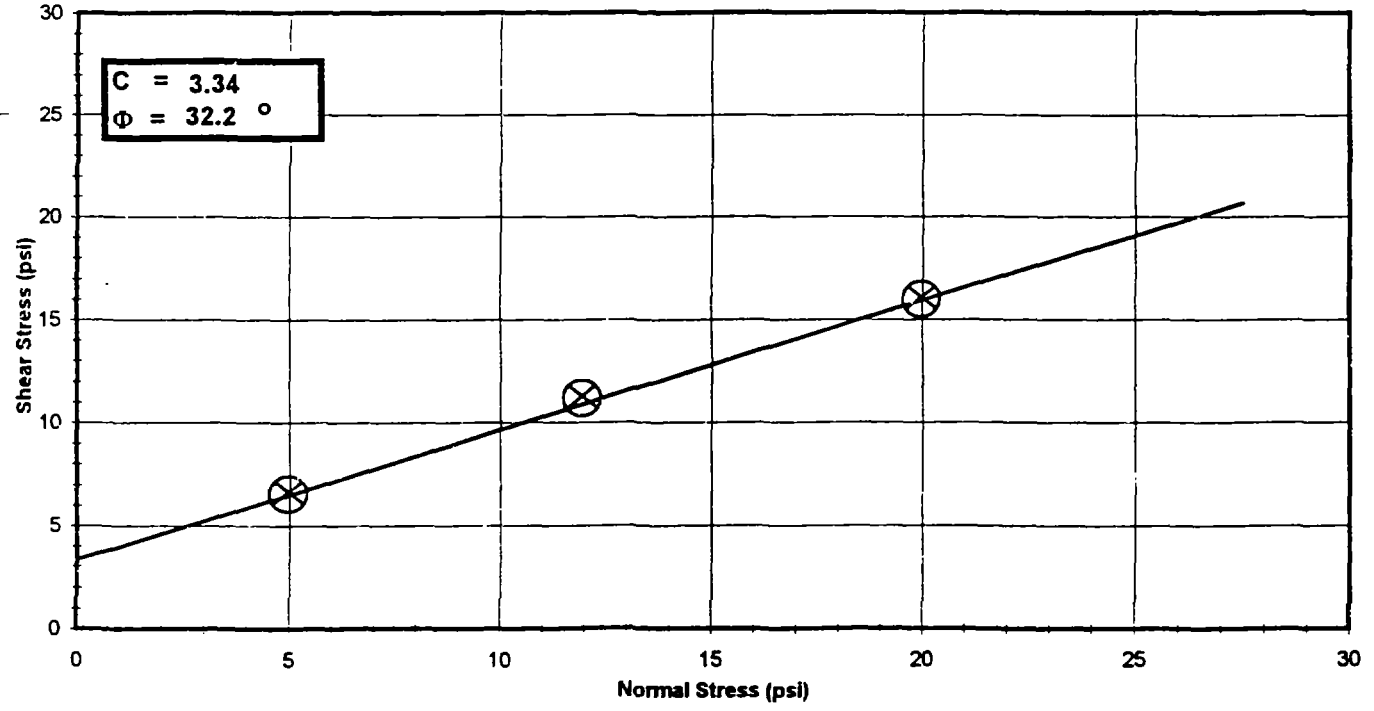
Slope	=	0.63	
C	=	**3.43**	
Φ	=	**32.17**	**degrees**

Selected Points	Shear Stress	Normal Stress
1	6.49	5
3	15.94	20

Selected Points Regression

Slope	≈	0.63	
C	≈	**3.34**	
Φ	=	**32.2**	**degrees**

SHEAR STRESS vs. NORMAL STRESS



Note: Graph not to scale

DCN: CT-S21
DATE: 02/17/00
REVISION 3

geotechnics

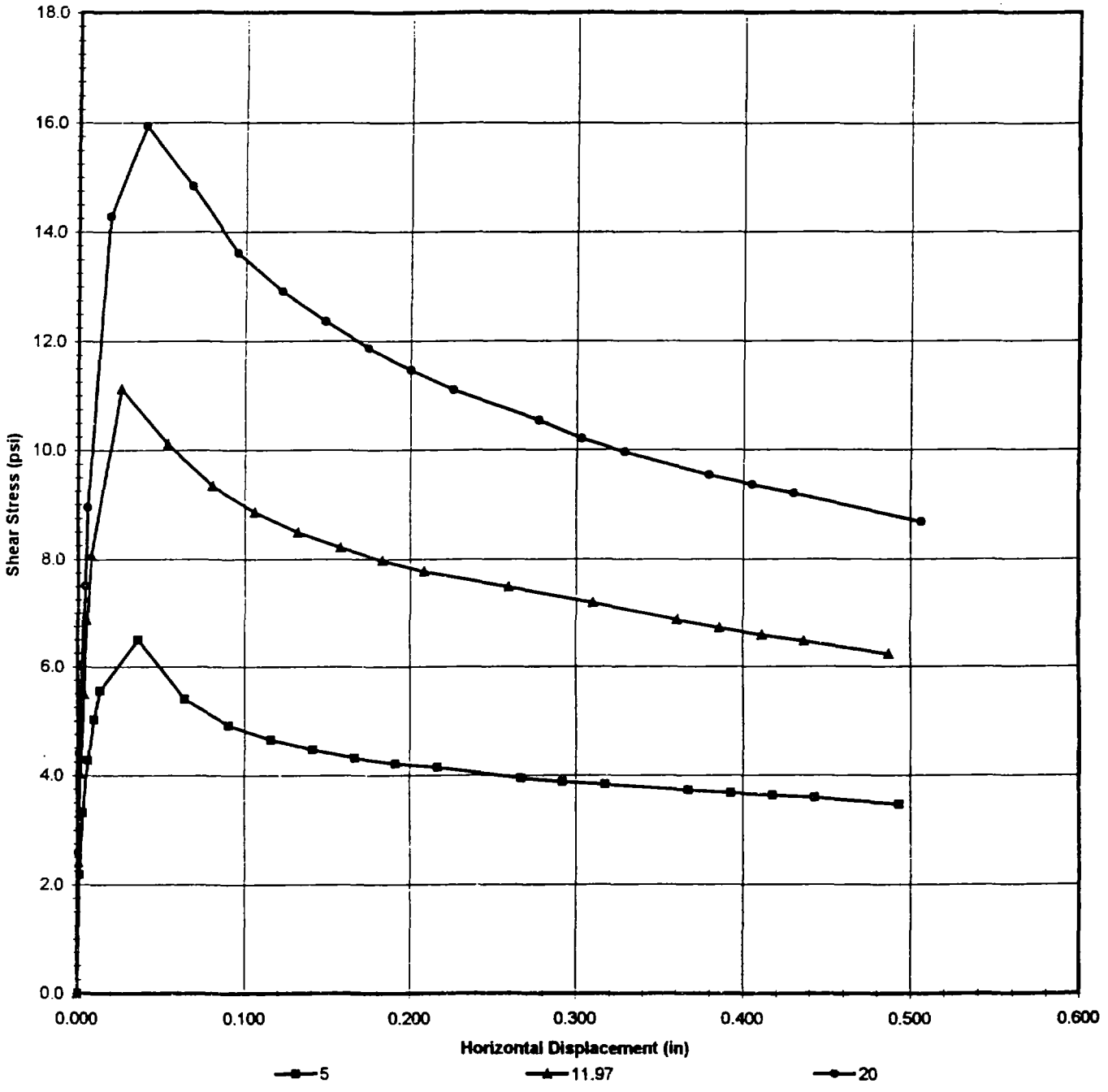
DIRECT SHEAR

ASTM D 3080-90 (SOP-S21)

Client	GEOTECHNICS	Boring No.	NA
Client Reference	GEOTEST TEMPLATE	Depth (ft)	NA
Project No.	00000-01	Sample No.	NA
Lab ID	00000.001	Visual Description	BROWN CLAY

Sample Conditions: REMOLDED, INUNDATED AND DOUBLE DRAINED

SHEAR STRESS vs. HORIZONTAL DISPLACEMENT



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DCN CT-S21
DATE 02/17/00
REVISION 3

Geotechnics

DIRECT SHEAR

ASTM D 3080-90 (SOP-S21)

Client	GEOTECHNICS	Boring No.	NA
Client Reference	GEOTEST TEMPLATE	Depth (ft)	NA
Project No.	00000-01	Sample No.	NA
Lab ID	00000.001	Visual Description	BROWN CLAY

Sample Conditions: REMOLDED, INUNDATED AND DOUBLE DRAINED

SHEAR BOX DATA

Wt.of Wet Specimen & Ring(gm)	278.79	Specific Gravity (Assumed)	2.70
Weight of Ring (gm)	110.71	Volume of Solids(cc)	55.5
Weight of Wet Specimen (gm)	168.08	Initial Consolidation Dial Reading	0
Initial Specimen Height(in)	1	Final Consolidation Dial Reading	-258.7
Specimen Diameter(in)	2.5	Corrected Final Cons. Reading	-260.7
Wet Density(pcf)	130.4	Void Ratio Before Consolidation	0.45
Dry Density(pcf)	**116.3**	**Void Ratio After Consolidation**	0.49

Moisture Content	*Before Test*	*After Test*	*Testing Parameters*	
Tare ID	538	11006		
Wt. Wet Soil & Tare (gm)	296.87	205.88	Normal Stress(psi)	**5**
Wt. Dry Soil & Tare (gm)	273.52	186.44		
Wt. Tare (gm)	82.05	90.23	Strain Rate(in/min)	0.00144
Wt. of Water (gm)	23.35	19.44		
Wt. of Dry Soil (gm)	191.47	96.21	Machine Deflection(div)	2
Moisture Content (%)	**12.2**	**20.2**		

Horizontal Dial Reading 1 div=0.001"	Horizontal Displacement (in)	Proving Ring Reading 1 div=0.0001"	Shear Force (lbs)	Shear Stress (psi)	Vertical Dial Reading 1 div= 0.0001"	Vertical Displacement (+)incr,(-)decr (in)	Shear To Normal Ratio
0.0	0.000	0.0	0.0	**0.00**	-258.7	0.0000	0.00
5.0	0.001	35.8	10.7	**2.18**	-262.6	0.0004	0.44
10.0	0.004	61.7	16.3	**3.31**	-266.8	0.0008	0.66
15.0	0.007	83.6	21.0	**4.27**	-272.8	0.0014	0.85
20.0	0.010	100.5	24.6	**5.02**	-280.8	0.0022	1.00
25.0	0.014	112.7	27.2	**5.55**	-289.8	0.0031	1.11
50.0	0.037	134.1	31.9	**6.49**	-344.9	0.0086	1.30
75.0	0.064	109.2	26.5	**5.39**	-381.0	0.0122	1.08
100.0	0.090	98.1	24.1	**4.91**	-397.5	0.0139	0.98
125.0	0.116	92.1	22.8	**4.65**	-409.4	0.0151	0.93
150.0	0.141	88.0	21.9	**4.47**	-418.7	0.0160	0.89
175.0	0.167	84.6	21.2	**4.32**	-426.1	0.0167	0.86
200.0	0.192	82.2	20.7	**4.21**	-432.5	0.0174	0.84
225.0	0.217	80.6	20.3	**4.14**	-437.8	0.0179	0.83
275.0	0.267	76.1	19.4	**3.94**	-446.6	0.0188	0.79
300.0	0.293	74.6	19.0	**3.88**	-450.0	0.0191	0.78
325.0	0.318	73.5	18.8	**3.83**	-454.0	0.0195	0.77
375.0	0.368	71.0	18.3	**3.72**	-459.8	0.0201	0.74
400.0	0.393	70.0	18.0	**3.68**	-462.7	0.0204	0.74
425.0	0.418	68.9	17.8	**3.63**	-465.1	0.0206	0.73
450.0	0.443	67.9	17.6	**3.58**	-467.5	0.0209	0.72
500.0	0.493	65.2	17.0	**3.47**	-471.8	0.0213	0.69

Tested By *TM* *Date* *3/28/00* *Checked By* *Date*

DCN CT-S21
DATE 02/17/00
REVISION 3

Geotechnics

DIRECT SHEAR

ASTM D 3080-90 (SOP-S21)

Client	GEOTECHNICS	Boring No.	NA
Client Reference	GEOTEST TEMPLATE	Depth (ft)	NA
Project No.	00000-01	Sample No.	NA
Lab ID	00000.001	Visual Description	BROWN CLAY

Sample Conditions: REMOLDED, INUNDATED AND DOUBLE DRAINED

SHEAR BOX DATA

Wt.of Wet Specimen & Ring(gm)	278.81	Specific Gravity (Assumed)	2.70
Weight of Ring (gm)	110.72	Volume of Solids(cc)	55.3
Weight of Wet Specimen (gm)	168.09	Initial Consolidation Dial Reading	0
Initial Specimen Height(in)	1	Final Consolidation Dial Reading	-112.7
Specimen Diameter(in)	2.5	Corrected Final Cons. Reading	-122.7
Wet Density(pcf)	130.5	Void Ratio Before Consolidation	0.45
Dry Density(pcf)	**115.9**	**Void Ratio After Consolidation**	0.47

Moisture Content	*Before Test*	*After Test*	*Testing Parameters*	
Tare ID	509	139		
Wt. Wet Soil & Tare (gm)	208.29	205.27	Normal Stress(psi)	**11.97**
Wt. Dry Soil & Tare (gm)	196.76	187.26		
Wt. Tare (gm)	104.89	94.82	Strain Rate(in/min)	0.00144
Wt. of Water (gm)	11.53	18.01		
Wt. of Dry Soil (gm)	91.87	92.44	Machine Deflection(div)	10
Moisture Content (%)	**12.6**	**19.5**		

Horizontal Dial Reading 1 div=0.001"	Horizontal Displacement (in)	Proving Ring Reading 1 div=0.0001"	Shear Force (lbs)	Shear Stress (psi)	Vertical Dial Reading 1 div= 0.0001"	Vertical Displacement (+)incr,(-)decr (in)	Shear To Normal Ratio
0.0	0.000	0.0	0.0	**0.00**	-112.7	0.0000	0.00
5.0	0.001	40.9	11.8	**2.40**	-115.2	0.0002	0.20
10.0	0.002	77.9	19.8	**4.02**	-117.4	0.0005	0.34
15.0	0.004	111.3	26.9	**5.49**	-120.6	0.0008	0.46
20.0	0.006	142.4	33.7	**6.86**	-125.2	0.0012	0.57
25.0	0.008	169.9	39.6	**8.06**	-130.8	0.0018	0.67
50.0	0.026	239.6	54.6	**11.12**	-174.4	0.0062	0.93
75.0	0.053	216.7	49.6	**10.11**	-209.5	0.0097	0.84
100.0	0.080	199.1	45.9	**9.34**	-227.2	0.0114	0.78
125.0	0.106	188.0	43.5	**8.85**	-238.6	0.0126	0.74
150.0	0.132	179.6	41.6	**8.48**	-247.4	0.0135	0.71
175.0	0.158	173.2	40.3	**8.21**	-254.5	0.0142	0.69
200.0	0.183	167.7	39.1	**7.96**	-260.3	0.0148	0.67
225.0	0.209	163.3	38.1	**7.77**	-265.3	0.0153	0.65
275.0	0.259	156.8	36.7	**7.49**	-274.3	0.0162	0.63
325.0	0.310	150.0	35.3	**7.19**	-280.1	0.0167	0.60
325.0	0.310	150.0	35.3	**7.19**	-280.1	0.0167	0.60
375.0	0.361	142.7	33.7	**6.87**	-283.6	0.0171	0.57
400.0	0.386	139.2	33.0	**6.71**	-285.5	0.0173	0.56
425.0	0.411	136.0	32.3	**6.57**	-286.8	0.0174	0.55
450.0	0.437	133.6	31.7	**6.47**	-288.0	0.0175	0.54
500.0	0.487	128.1	30.6	**6.23**	-290.1	0.0177	0.52

Tested By *TM* *Date* *3/29/00* *Checked By* *Date*

DCN CT-S21
DATE 02/17/00
REVISION 3

Geotechnics

DIRECT SHEAR

ASTM D 3080-90 (SOP-S21)

Client	GEOTECHNICS	Boring No.	NA
Client Reference	GEOTEST TEMPLATE	Depth (ft)	NA
Project No.	00000-01	Sample No.	NA
Lab ID	00000.001	Visual Description	BROWN CLAY

Sample Conditions: REMOLDED, INUNDATED AND DOUBLE DRAINED

SHEAR BOX DATA

Wt.of Wet Specimen & Ring(gm)	278.81	Specific Gravity (Assumed)	2.70
Weight of Ring (gm)	110.72	Volume of Solids(cc)	55.4
Weight of Wet Specimen (gm)	168.09	Initial Consolidation Dial Reading	0
Initial Specimen Height(in)	1	Final Consolidation Dial Reading	1.4
Specimen Diameter(in)	2.5	Corrected Final Cons. Reading	-5.6
Wet Density(pcf)	130.5	Void Ratio Before Consolidation	0.45
Dry Density(pcf)	**116.1**	**Void Ratio After Consolidation**	0.45

Moisture Content	*Before Test*	*After Test*	*Testing Parameters*	
Tare ID	676	444		
Wt. Wet Soil & Tare (gm)	194.74	236.55	Normal Stress(psi)	**20**
Wt. Dry Soil & Tare (gm)	181.51	214.51		
Wt. Tare (gm)	74.35	99.84	Strain Rate(in/min)	0.00144
Wt. of Water (gm)	13.23	22.04		
Wt. of Dry Soil (gm)	107.16	114.67	Machine Deflection(div)	7
Moisture Content (%)	**12.3**	**19.2**		

Horizontal Dial Reading 1 div=0.001"	Horizontal Displacement (in)	Proving Ring Reading 1 div=0.0001"	Shear Force (lbs)	Shear Stress (psi)	Vertical Dial Reading 1 div= 0.0001"	Vertical Displacement (+)incr,(-)decr (in)	Shear To Normal Ratio
0.0	0.000	0.0	0.0	**0.00**	1.4	0.0000	0.00
5.0	0.000	45.3	12.7	**2.59**	0.0	0.0001	0.13
10.0	0.001	86.4	21.6	**4.40**	-1.1	0.0002	0.22
15.0	0.003	123.5	29.6	**6.02**	-2.6	0.0004	0.30
20.0	0.004	157.3	36.9	**7.51**	-4.8	0.0006	0.38
25.0	0.006	190.0	43.9	**8.94**	-7.9	0.0009	0.45
50.0	0.019	311.6	70.1	**14.28**	-32.8	0.0034	0.71
75.0	0.040	349.4	78.2	**15.94**	-68.5	0.0070	0.80
100.0	0.068	324.1	72.8	**14.83**	-95.0	0.0096	0.74
125.0	0.095	296.5	66.8	**13.61**	-106.9	0.0108	0.68
150.0	0.122	280.4	63.4	**12.91**	-112.5	0.0114	0.65
175.0	0.148	267.7	60.6	**12.35**	-116.1	0.0117	0.62
200.0	0.174	256.7	58.3	**11.87**	-118.3	0.0120	0.59
225.0	0.200	247.3	56.2	**11.46**	-119.5	0.0121	0.57
250.0	0.226	239.1	54.5	**11.10**	-119.9	0.0121	0.55
300.0	0.277	226.3	51.7	**10.54**	-120.7	0.0122	0.53
325.0	0.303	218.8	50.1	**10.21**	-120.7	0.0122	0.51
350.0	0.329	213.0	48.9	**9.95**	-120.2	0.0122	0.50
400.0	0.380	203.6	46.8	**9.54**	-119.2	0.0121	0.48
425.0	0.405	199.5	45.9	**9.36**	-118.6	0.0120	0.47
450.0	0.430	195.7	45.1	**9.19**	-117.6	0.0119	0.46
525.0	0.507	183.9	42.6	**8.67**	-116.1	0.0117	0.43

Tested By TM *Date* 3/27/00 *Checked By* *Date*

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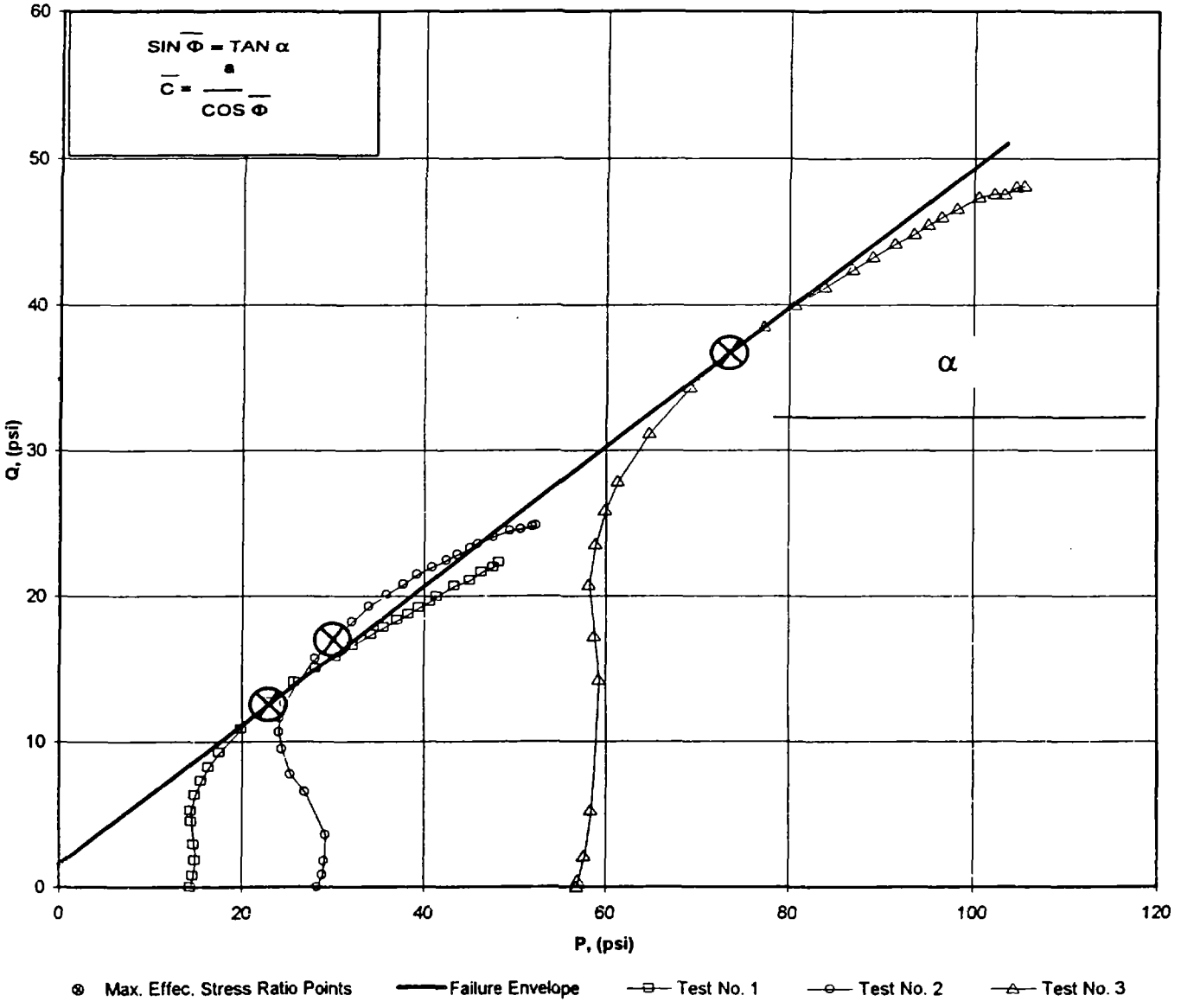
geotechnics

CONSOLIDATED UNDRAINED TRIAXIAL TEST
WITH PORE PRESSURE READINGS
ASTM D - 4767 (SOP-S28)

Client	GEOTECHNICS	Lab ID	97000-01.001
Client Reference	QA-PROGRAM	Boring No.	NA
Project No.	970000	Depth(ft.)	NA
		Sample No.	NA

Consolidated Undrained Triaxial Test with Pore Pressure



a	=	1.59	$\bar{C}$	=	1.81
α	=	25.5	$\bar{\Phi}$	=	28.53

Tested By JM Date 4/27/97 Checked By Date

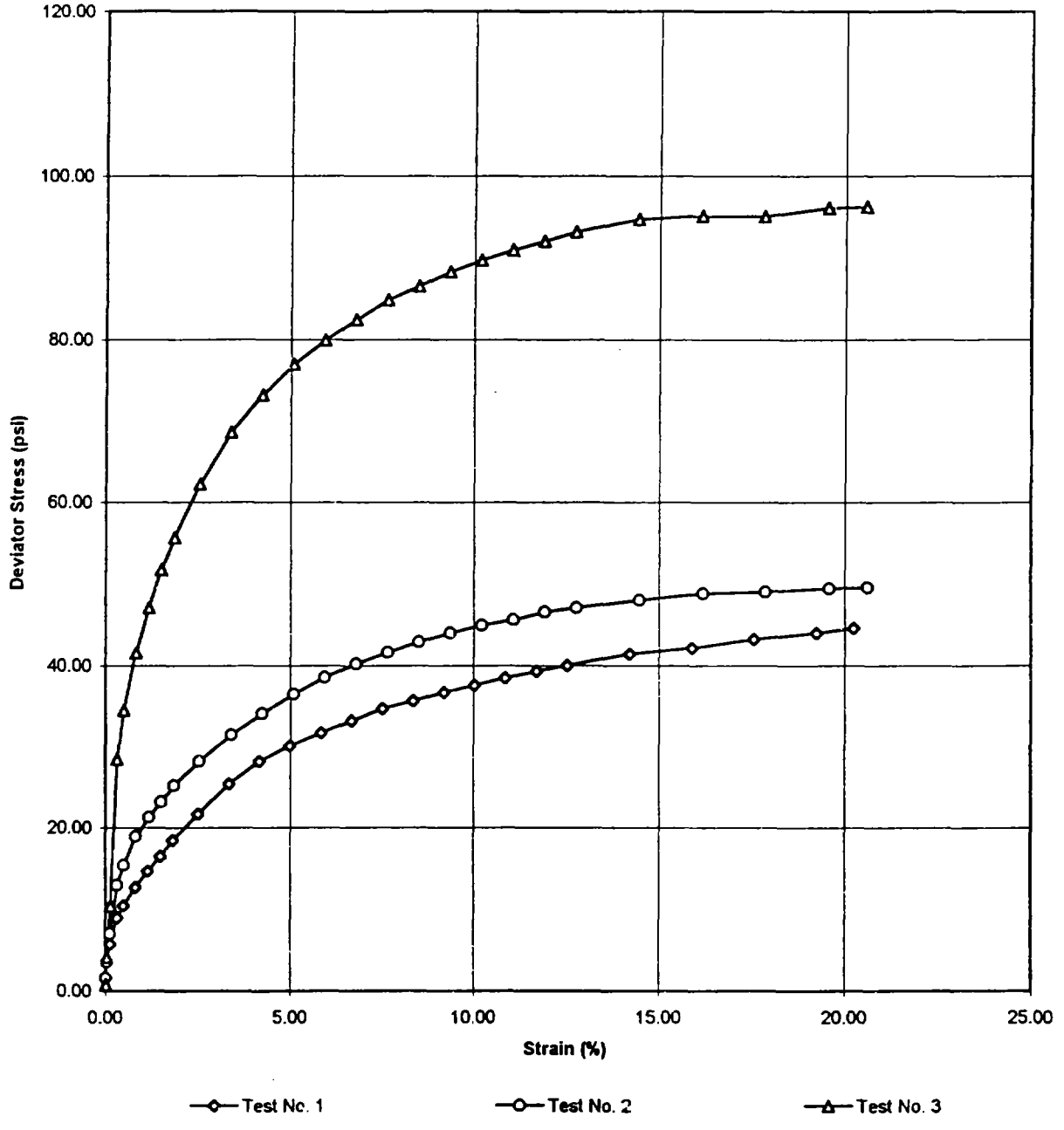
DCN: CT-S28 DATE 6-25-98 REVISION 1

Geotechnics

CONSOLIDATED UNDRAINED TRIAXIAL TEST
WITH PORE PRESSURE READINGS
ASTM D - 4767 (SOP-S28)

Client	GEOTECHNICS	Lab ID	97000-00.001
Client Reference	QA-PROGRAM	Boring No.	NA
Project No.	970000.00	Depth(ft.)	NA
		Sample No.	NA

Visual Description: NA



Tested By JM Date 4/27/97 Checked By Date

Geotechnics

CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE READINGS

ASTM D - 4767 (SOP-S28)

Client	GEOTECHNICS	Lab ID	97000-00.001
Client Reference	QA-PROGRAM	Boring No.	NA
Project No.	970000	Depth(ft.)	NA
		Sample No.	NA

Visual Description: NA

Stage No.	1
Test No	1

PRESSURES (psi)

Cell Pressure(psi)	44.3
Back Pressure(psi)	29.9
Eff. Cons. Pressure(psi)	14.4
Pore Pressure Response (%)	98

MAXIMUM OBLIQUITY POINTS

$\overline{P}$	=	22.95
Q	=	12.55

INITIAL SAMPLE DIMENSIONS (in)

Length 1	6.014	Diameter 1	2.869
Length 2	6.014	Diameter 2	2.869
Length 3	6.014	Diameter 3	2.869
Avg Leng.	6.014	Avg. Diam.	2.869

VOLUME CHANGE

Initial Burette Reading (ml)	28.0
Final Burette Reading (ml)	12.0
Final Change (ml)	16.0

Initial Dial Reading (D.R.), mils	45
D.R. After Saturation, mils	71
D.R. After Consolidation, mils	87

LOAD (LBS)	DEFORMATION (DIVISIONS)	PORE PRESSURE (PSI)
8.0	0	29.9
18.0	1	30.4
31.0	3	31.2
44.6	8	32.5
64.5	19	34.3
73.8	29	35.1
88.2	49	35.7
100.8	69	36.1
113.0	89	36.2
126.0	109	36.0
147.6	149	35.2
172.8	199	33.9
192.4	249	32.6
206.7	299	31.2
219.5	349	29.9
231.2	399	28.8
243.5	449	27.5
252.1	499	26.6
261.4	549	25.6
269.6	599	24.8
278.4	649	24.1
286.8	699	23.3
294.1	749	22.9
310.3	849	21.7
321.8	949	20.3
336.6	1049	19.6
348.8	1149	18.6
357.9	1209	18.3
357.9	1209	18.3
357.9	1209	18.3

Tested By JM Date 4/27/97 Checked By Date

Geotechnics

CONSOLIDATED UNDRAINED TRIAXIAL TEST
WITH PORE PRESSURE READINGS
ASTM D - 4767 (SOP-S28)

Client	GEOTECHNICS	Lab ID	97000-00.001
Client Reference	QA-PROGRAM	Boring No.	NA
Project No.	970000	Depth(ft.)	NA
		Sample No.	NA
Visual Description:	NA		

Effective Confining Pressure (psi)	14	*Stage No.*	1
		Test No	1

INITIAL DIMENSIONS

Initial Sample Length (in.)	6.01
Initial Sample Diameter (in.)	2.87
Initial Sample Area (in^2)	6.46
Initial Sample Volume (in^3)	38.88

VOLUME CHANGE

Volume After Consolidation (in^3)	37.40
Length After Consolidation (in)	5.97
Area After Consolidation (in^2)	6.262

Strain (%)	Deviation Stress	ΔU	$\overline{\sigma_1}$	$\overline{\sigma_3}$	Effective Principle Stress Ratio	$\overline{A}$	$\overline{P}$	Q
0.02	1.60	0.50	15.50	13.9	1.115	0.32	14.70	0.80
0.05	3.67	1.30	16.77	13.1	1.280	0.36	14.94	1.84
0.13	5.84	2.60	17.64	11.8	1.495	0.45	14.72	2.92
0.32	8.99	4.40	18.99	10.0	1.899	0.50	14.50	4.50
0.49	10.46	5.20	19.66	9.2	2.137	0.51	14.43	5.23
0.82	12.70	5.80	21.30	8.6	2.477	0.47	14.95	6.35
1.16	14.65	6.20	22.85	8.2	2.786	0.43	15.52	7.32
1.49	16.52	6.30	24.62	8.1	3.039	0.39	16.36	8.26
1.83	18.50	6.10	26.80	8.3	3.229	0.34	17.55	9.25
2.49	21.74	5.30	30.84	9.1	3.389	0.25	19.97	10.87
3.33	25.44	4.00	35.84	10.4	3.446	0.16	23.12	12.72
4.17	28.22	2.70	39.92	11.7	3.412	0.10	25.81	14.11
5.01	30.14	1.30	43.24	13.1	3.301	0.04	28.17	15.07
5.84	31.80	0.00	46.20	14.4	3.208	0.00	30.30	15.90
6.68	33.26	-1.10	48.76	15.5	3.146	-0.03	32.13	16.63
7.52	34.78	-2.40	51.58	16.8	3.070	-0.07	34.19	17.39
8.36	35.72	-3.30	53.42	17.7	3.018	-0.09	35.56	17.86
9.19	36.74	-4.30	55.44	18.7	2.965	-0.12	37.07	18.37
10.03	37.58	-5.10	57.08	19.5	2.927	-0.14	38.29	18.79
10.87	38.49	-5.80	58.69	20.2	2.905	-0.15	39.44	19.24
11.70	39.31	-6.60	60.31	21.0	2.872	-0.17	40.65	19.65
12.54	39.96	-7.00	61.36	21.4	2.867	-0.18	41.38	19.98
14.22	41.41	-8.20	64.01	22.6	2.832	-0.20	43.31	20.71
15.89	42.15	-9.60	66.15	24.0	2.756	-0.23	45.07	21.07
17.57	43.26	-10.30	67.96	24.7	2.751	-0.24	46.33	21.63
19.24	43.95	-11.30	69.65	25.7	2.710	-0.26	47.68	21.98
20.24	44.56	-11.60	70.56	26.0	2.714	-0.27	48.28	22.28
20.24	44.56	-11.60	70.56	26.0	2.714	-0.27	48.28	22.28
20.24	44.56	-11.60	70.56	26.0	2.714	-0.27	48.28	22.28

Tested By JM Date 4/27/97 Checked By Date

CONSOLIDATED UNDRAINED TRIAXIAL TEST
WITH PORE PRESSURE READINGS
ASTM D - 4767 (SOP-S28)

Client	GEOTECHNICS	Lab ID	97000-00.001
Client Reference	QA-PROGRAM	Boring No.	NA
Project No.	970000.00	Depth(ft.)	NA
		Sample No.	NA

Visual Description: NA

Stage No.	1
Test No	2

PRESSURES (psi)

Cell Pressure(psi)	68.5
Back Pressure(psi)	40.2
Eff. Cons. Pressure(p	28.3
Pore Pressure Response (%)	98

MAXIMUM OBLIQUITY POINTS

$\overline{P}$	=	29.96
Q	=	17.06

INITIAL SAMPLE DIMENSIONS (in)

Length 1	6.014	Diameter 1	2.869
Length 2	6.014	Diameter 2	2.869
Length 3	6.014	Diameter 3	2.869
Avg Leng.	6.014	Avg. Diam.	2.869

VOLUME CHANGE

Initial Burette Reading (ml)	48.0
Final Burette Reading (ml)	28.0
Final Change (ml)	20.0

Initial Dial Reading (D.R.), mils	60
D.R. After Saturation, mils	131
D.R. After Consolidation, mils	211

LOAD (LBS)	DEFORMATION (DIVISIONS)	PORE PRESSURE (PSI)
10.0	0	40.2
20.0	1	40.4
32.0	3	41.2
54.2	8	42.9
90.8	19	48.1
105.9	29	50.9
128.3	49	53.6
143.5	69	55.1
156.0	89	56.0
169.0	109	56.4
189.0	149	56.4
211.8	199	56.2
230.8	249	55.6
248.1	299	54.7
263.9	349	53.9
276.6	399	52.7
289.0	449	51.6
300.3	499	50.7
310.0	549	49.6
319.4	600	48.5
327.4	649	47.6
336.9	699	46.7
344.0	749	46.1
357.4	849	44.9
370.8	949	43.5
379.8	1049	42.4
390.6	1149	41.3
396.6	1209	41.0
396.6	1209	41.0
396.6	1209	41.0

Tested By JM Date 4/27/97 Checked By Date

Geotechnics

CONSOLIDATED UNDRAINED TRIAXIAL TEST
WITH PORE PRESSURE READINGS
ASTM D - 4767 (SOP-S28)

Client	GEOTECHNICS	Lab ID	97000-00.001
Client Reference	QA-PROGRAM	Boring No.	NA
Project No.	970000	Depth(ft.)	NA
		Sample No.	NA
Visual Description:	NA		

Effective Confining Pressure (psi)	28	*Stage No.*	1
		Test No	2

INITIAL DIMENSIONS

Initial Sample Length (in.)	6.01
Initial Sample Diameter (in.)	2.87
Initial Sample Area (in^2)	6.46
Initial Sample Volume (in^3)	*38.88*

VOLUME CHANGE

Volume After Consolidation (in^3)	36.28
Length After Consolidation (in)	5.86
Area After Consolidation (in^2)	6.188

Strain (%)	Deviation Stress	ΔU	$\overline{\sigma_1}$	$\overline{\sigma_3}$	Effective Principle Stress Ratio	$\overline{A}$	$\overline{P}$	Q
0.02	1.62	0.20	29.72	28.1	1.057	0.13	28.91	0.81
0.05	3.55	1.00	30.85	27.3	1.130	0.29	29.08	1.78
0.14	7.13	2.70	32.73	25.6	1.279	0.39	29.17	3.57
0.32	13.01	7.90	33.41	20.4	1.638	0.62	26.91	6.51
0.49	15.42	10.70	33.02	17.6	1.876	0.71	25.31	7.71
0.84	18.96	13.40	33.86	14.9	2.272	0.72	24.38	9.48
1.18	21.32	14.90	34.72	13.4	2.591	0.71	24.06	10.66
1.52	23.24	15.80	35.74	12.5	2.859	0.69	24.12	11.62
1.86	25.22	16.20	37.32	12.1	3.084	0.66	24.71	12.61
2.54	28.19	16.20	40.29	12.1	3.330	0.59	26.20	14.10
3.39	31.50	16.00	43.80	12.3	3.561	0.52	28.05	15.75
4.25	34.17	15.40	47.07	12.9	3.648	0.46	29.98	17.08
5.10	36.51	14.50	50.31	13.8	3.646	0.41	32.06	18.26
5.95	38.59	13.70	53.19	14.6	3.643	0.36	33.89	19.29
6.81	40.15	12.50	55.95	15.8	3.541	0.32	35.88	20.08
7.66	41.63	11.40	58.53	16.9	3.463	0.28	37.72	20.82
8.51	42.92	10.50	60.72	17.8	3.411	0.25	39.26	21.46
9.36	43.94	9.40	62.84	18.9	3.325	0.22	40.87	21.97
10.23	44.88	8.30	64.88	20.0	3.244	0.19	42.44	22.44
11.07	45.61	7.40	66.51	20.9	3.182	0.17	43.71	22.81
11.92	46.53	6.50	68.33	21.8	3.134	0.14	45.06	23.26
12.78	47.08	5.90	69.48	22.4	3.102	0.13	45.94	23.54
14.48	48.01	4.70	71.61	23.6	3.034	0.10	47.60	24.00
16.19	48.87	3.30	73.87	25.0	2.955	0.07	49.43	24.43
17.89	49.07	2.20	75.17	26.1	2.880	0.05	50.63	24.53
19.60	49.45	1.10	76.65	27.2	2.818	0.02	51.93	24.73
20.62	49.59	0.80	77.09	27.5	2.803	0.02	52.30	24.80
20.62	49.59	0.80	77.09	27.5	2.803	0.02	52.30	24.80
20.62	49.59	0.80	77.09	27.5	2.803	0.02	52.30	24.80

Tested By JM Date 4/27/97 Checked By Date

Geotechnics

CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE READINGS

ASTM D - 4767 (SOP-S28)

Client	GEOTECHNICS	Lab ID	97000-00.001
Client Reference	QA-PROGRAM	Boring No.	NA
Project No.	970000.00	Depth(ft.)	NA
		Sample No.	NA

Visual Description: NA

Stage No.	1
Test No	3

PRESSURES (psi)

Cell Pressure(psi)	87
Back Pressure(psi)	30.1
Eff. Cons. Pressure(p	56.9
Pore Pressure Response (%)	97

MAXIMUM OBLIQUITY POINTS

$\overline{P}$	=	73.49
Q	=	36.69

INITIAL SAMPLE DIMENSIONS (in)

Length 1	6.014	Diameter 1	2.869
Length 2	6.014	Diameter 2	2.869
Length 3	6.014	Diameter 3	2.869
Avg Leng.	6.014	Avg. Diam.	2.869

VOLUME CHANGE

Initial Burette Reading (ml)	72.0
Final Burette Reading (ml)	44.5
Final Change (ml)	27.5

Initial Dial Reading (D.R.), mils	60
D.R. After Saturation, mils	97
D.R. After Consolidation, mils	189

LOAD (LBS)	DEFORMATION (DIVISIONS)	PORE PRESSURE (PSI)
12.0	0	30.1
17.0	1	30.4
38.0	3	31.4
77.0	8	33.8
189.1	19	41.9
227.4	29	45.5
271.8	49	49.6
307.3	69	51.6
337.6	89	52.9
363.8	109	53.5
408.0	149	53.3
452.2	199	52.1
485.9	249	50.2
514.7	299	48.2
538.9	349	46.3
560.4	399	44.3
581.6	449	42.5
598.6	499	41.2
616.2	549	39.7
631.4	599	38.3
645.9	649	37.4
659.5	699	36.5
674.0	749	35.4
698.4	849	33.8
715.4	949	32.3
729.7	1049	31.2
752.3	1149	30.4
763.1	1210	29.6
763.1	1210	29.6
763.1	1210	29.6

Tested By JM Date 4/27/97 Checked By Date

Geotechnics

CONSOLIDATED UNDRAINED TRIAXIAL TEST
WITH PORE PRESSURE READINGS
ASTM D - 4767 (SOP-S28)

Client	GEOTECHNICS	Lab ID	97000-00.001
Client Reference	QA-PROGRAM	Boring No.	NA
Project No.	970000	Depth(ft.)	NA
		Sample No.	NA
Visual Description:	NA		

Effective Confining Pressure (psi)	57	*Stage No.*	1
		Test No	3

INITIAL DIMENSIONS

Initial Sample Length (in.)	6.01
Initial Sample Diameter (in.)	2.87
Initial Sample Area (in^2)	6.46
Initial Sample Volume (in^3)	38.88

VOLUME CHANGE

Volume After Consolidation (in^3)	36.48
Length After Consolidation (in)	5.89
Area After Consolidation (in^2)	6.199

Strain (%)	Deviation Stress	ΔU	$\overline{\sigma}_1$	$\overline{\sigma}_3$	Effective Principle Stress Ratio	$\overline{A}$	$\overline{P}$	Q
0.02	0.81	0.30	57.41	56.6	1.014	0.38	57.00	0.40
0.05	4.19	1.30	59.79	55.6	1.075	0.32	57.70	2.10
0.14	10.47	3.70	63.67	53.2	1.197	0.36	58.44	5.24
0.32	28.48	11.80	73.58	45.1	1.631	0.43	59.34	14.24
0.49	34.57	15.40	76.07	41.5	1.833	0.46	58.79	17.29
0.83	41.56	19.50	78.96	37.4	2.111	0.48	58.18	20.78
1.17	47.08	21.50	82.48	35.4	2.330	0.47	58.94	23.54
1.51	51.73	22.80	85.83	34.1	2.517	0.45	59.96	25.86
1.85	55.70	23.40	89.20	33.5	2.663	0.43	61.35	27.85
2.53	62.26	23.20	95.96	33.7	2.847	0.38	64.83	31.13
3.38	68.61	22.00	103.51	34.9	2.966	0.33	69.20	34.30
4.23	73.21	20.10	110.01	36.8	2.989	0.28	73.40	36.60
5.08	76.97	18.10	115.77	38.8	2.984	0.24	77.28	38.48
5.93	79.95	16.20	120.65	40.7	2.964	0.21	80.68	39.98
6.78	82.46	14.20	125.16	42.7	2.931	0.18	83.93	41.23
7.63	84.87	12.40	129.37	44.5	2.907	0.15	86.94	42.44
8.48	86.60	11.10	132.40	45.8	2.891	0.13	89.10	43.30
9.33	88.37	9.60	135.67	47.3	2.868	0.11	91.48	44.18
10.18	89.74	8.20	138.44	48.7	2.843	0.09	93.57	44.87
11.03	90.98	7.30	140.58	49.6	2.834	0.08	95.09	45.49
11.88	92.04	6.40	142.54	50.5	2.823	0.07	96.52	46.02
12.73	93.19	5.30	144.79	51.6	2.806	0.06	98.20	46.60
14.43	94.75	3.70	147.95	53.2	2.781	0.04	100.57	47.37
16.13	95.17	2.20	149.87	54.7	2.740	0.02	102.28	47.58
17.82	95.13	1.10	150.93	55.8	2.705	0.01	103.37	47.57
19.52	96.10	0.30	152.70	56.6	2.698	0.00	104.65	48.05
20.56	96.25	-0.50	153.65	57.4	2.677	-0.01	105.52	48.12
20.56	96.25	-0.50	153.65	57.4	2.677	-0.01	105.52	48.12
20.56	96.25	-0.50	153.65	57.4	2.677	-0.01	105.52	48.12

Tested By JM Date 4/27/97 Checked By Date

Geotechnics

CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE READINGS

ASTM D - 4767 (SOP-S28)

Client	GEOTECHNICS		
Client Reference	QA-PROGRAM		
Project No.	980000		
Lab ID	98000-00.001	Specific Gravity (assumed)	2.7

Visual Description: NA

SAMPLE CONDITION SUMMARY

Boring No.	NA	NA	NA
Depth (ft)	NA	NA	NA
Sample No.	NA	NA	NA
Test No.	T1	T2	T3
Deformation Rate (in/min)	0.002	0.002	0.002
Back Pressure (psi)	50.2	40.6	40.5
Consolidation Time (days)	1	1	1
Initial State (w%)	25.0	25.0	25.0
Total Unit Weight (pcf)	98.0	98.0	98.0
Dry Unit Weight (pcf)	78.4	78.4	78.4
Final State (w%)	14.0	13.0	13.3
Initial State Void Ratio,e	1.150	1.150	1.150

Tested By JM Date 6/25/98 Checked By Date

DCN: CT-S28A DATE: 6-25-98 REVISION: 1 N:\Excel QA\Spreadsheets\[TRIASUM.XLS]Sheet1

Geotechnics

GEOSYNTHETIC SAMPLE DATA

CONFORMANCE TEST RESULTS

geotechnics

CLIENT: QA ENGINEERING, INC.
CLIENT PROJECT: SANITARY LANDFILL
CLIENT PROJ. NO.: Not Provided
PROJECT NO.: L00-000-01
LAB ID NO.: L00-000-01-01
MATERIAL: 60 MIL TEXTURED HDPE
SAMPLE I.D. Not Provided
ROLL NO: Not Provided

TEST	ASTM METHOD	UNITS	SPECIMEN NO. 1	2	3	4	5	AVE	STD
THICKNESS	D 5199-95	mils	52.2	54.2	59.4	51.9	57.1		
			53.7	61.6	52.8	51.4	54.1	**54.8**	3.42
DENSITY	D 1505-90	g/cc	0.9493	0.9493	0.9493			**0.9493**	0.0000
CARBON BLACK CONTENT	D 1603-94	%	2.47	2.44				**2.45**	0.018
MELT FLOW	D 1238-95B COND E	g/10min	0.2821					**0.2821**	
			SPECIMEN NO.						
CARBON BLACK DISPERSION	D 2663-95 &NSF 1993	RATING	1 A-1	2 A-1	3 A-1	4 A-1	5 A-1	6 A-1	**AVE. A-1**
PUNCTURE RESISTANCE	FTMS 101C Method 2065	lbs	84.1	89.0	89.8	86.2	90.7		
			91.0	89.7	89.8	101.3	88.6	**90.0**	4.49
TEAR RESISTANCE	D 1004-94	MD-lbs	43.4	48.2	49.6	51.5	51.9		
			50.3	51.0	48.7	53.4	48.2	**49.6**	2.77
		CD-lbs	46.2	50.7	49.0	43.0	48.2		
			49.7	47.5	50.1	48.9	48.0	**48.1**	2.23
TENSILE PROPERTIES	D 638-95 &NSF 1993								
TRENGTH AT YIELD		MD-ppi	164	150	156	152	156	**156**	5.29
		CD-ppi	152	149	166	162	153	**156**	7.26
STRENGTH AT BREAK		MD-ppi	157	112	204	208	205	**177**	42.33
		CD-ppi	164	132	132	178	118	**145**	25.30
ELONGATION AT YIELD		MD%	14	15	14	13	14	**13.9**	0.74
Lo = 1.3" (NSF 54,1993)		CD%	15	13	13	13	13	**13.5**	0.67
ELONGATION AT BREAK		MD%	374	44	518	538	517	**398**	208.59
Lo = 2.5" (NSF 54,1993)		CD%	434	375	137	454	148	**309**	155.23
ELONGATION AT BREAK		MD%	467	55	647	673	646	**498**	260.74
Lo = 2.0"		CD%	542	469	171	567	185	**387**	194.04

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Geotechnics

PEEL AND SHEAR TEST RESULTS
DESTRUCTIVE SEAM TESTING
ASTM D 6392-99

CLIENT: QA ENGINEERING, INC.
CLIENT PROJECT: SANITARY LANDFILL

CLIENT PROJ. NO.: Not Provided
PROJECT NO.: L00000-01
LAB ID NO.: L00000-01-03
MATERIAL: 60 MIL TEXTURED GEOMEMBRANE
SEAM TYPE: DOUBLE FUSION

SAMPLE I.D.: DS-1

PEEL ADHESION

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE	PEEL INCURSION (%)
OUTSIDE TRACK (WELD "A")			
1	134.8	FTB-SE1	<10
2	132.4	FTB-SE1	<10
3	129.7	FTB-SE1	<10
4	128.6	FTB-SE1	<10
5	128.4	FTB-SE1	<10
AVERAGE	**130.8**		
STD. DEV.	2.76		
INSIDE TRACK (WELD "B")			
6	132.8	FTB-SE1	<10
7	139.0	FTB-SE1	<10
8	133.0	FTB-SE1	<10
9	131.8	FTB-SE1	<10
10	154.3	FTB-SE1	<10
AVERAGE	**138.2**		
STD. DEV.	9.45		

BONDED SEAM (SHEAR) STRENGTH

REPLICATE No.	PEAK LOAD (lbs/in)	EPA BREAK CLASSIFICATION CODE
1	174.7	FTB-BRK
2	183.4	FTB-BRK
3	181.6	FTB-BRK
4	182.9	FTB-BRK
5	182.8	FTB-BRK
AVERAGE	**181.1**	
STD. DEV.	3.63	

CHECKED BY: _____ DATE: _____

CONFORMANCE TEST RESULTS

CLIENT: QA ENGINEERING, INC.
CLIENT PROJECT: SANITARY LANDFILL
CLIENT PROJ. NO.: Not Provided
PROJECT NO.: L00-000-01
LAB IDNO.: L00-000-01-01
MATERIAL: NONWOVEN GEOTEXTILE
SAMPLE I.D. Not Provided
ROLL NO: Not Provided

TEST	ASTM METHOD	UNITS	SPECIMEN NO. 1	2	3	4	5	6	7	8	9	10	AVG	STD
GRAB STRENGTH	D 4632-99	MD-lbs	257.1	311.1	336.3	314.9	228.5	245.1	241.3	271.5	297.7	249.3	**275.3**	37.05
		CD-lbs	246.5	259.1	240.2	269.5	271.4	284.0	305.5	234.7	226.3	209.4	**254.7**	28.85
GRAB ELONGATION	D 4632-99	MD-%	98.0	98.0	104.3	94.7	93.7	94.7	95.7	98.7	121.3	100.0	**99.9**	8.16
		CD-%	109.7	101.0	116.3	105.3	92.3	102.3	111.3	100.3	90.7	110.0	**103.9**	8.27
TRAPEZOIDAL TEAR	D 4533-96	MD-lbs	134.8	107.3	137.5	149.3	140.8	134.9	160.9	174.2	163.6	169.9	**147.3**	20.38
		CD-lbs	142.4	168.9	131.9	121.0	133.6	137.2	111.6	158.2	119.6	139.2	**136.4**	17.44
PUNCTURE	D 4833-96	lbs	73.2	104.6	101.1	90.4	107.3	92.2	86.7	86.4	97.1	78.9		
		lbs	78.9	85.0	84.9	91.5	101.6						**90.7**	10.09
PERMITTIVITY	D 4491-99	sec-1	0.18	0.18	0.19	0.17							**0.18**	
A.O.S.[1]	D-4751-99	mm	0.075	0.075	0.105	0.075	0.075						**0.081**	
									AVERAGE AOS, US STD. SIEVE SIZE=				**#170**	

NOTES: (1) Starting with larger diameter glass beads and working to a smaller glass bead size(s).

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Geotechnics

APPARENT OPENING SIZE

ASTM D 4751-99

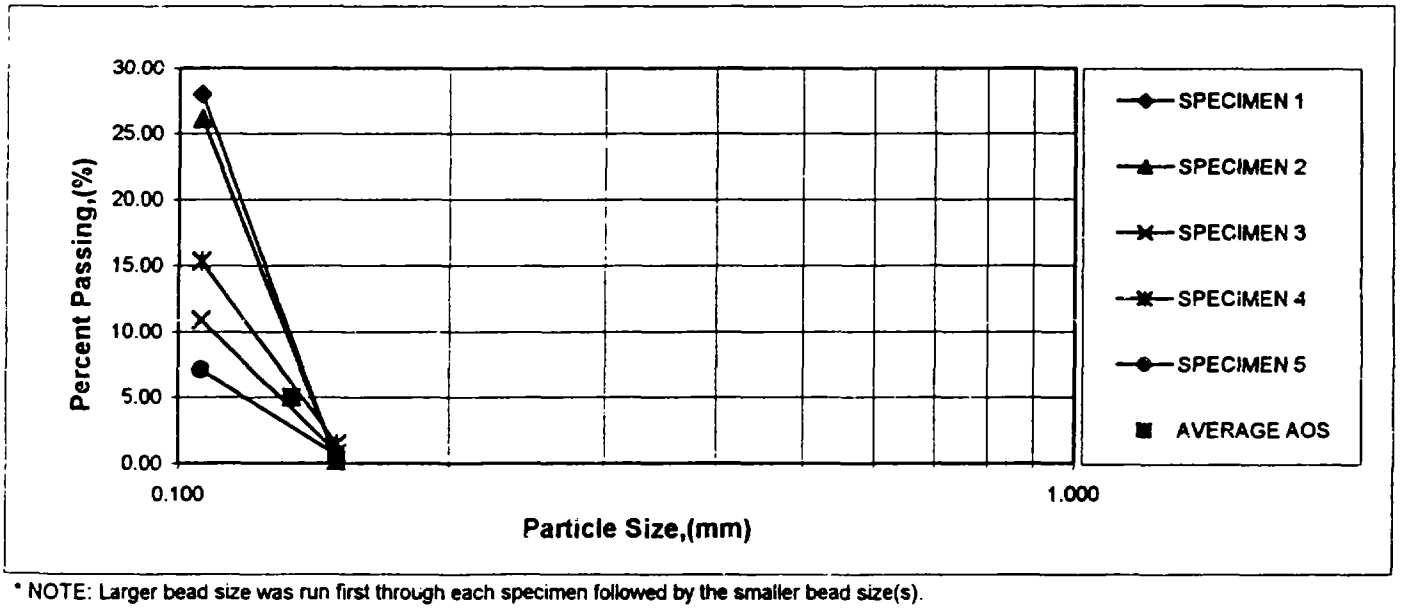
Geotechnics

CLIENT: QA ENGINEER, INC.
CLIENT PROJECT: SANITARY LANDFILL
PROJECT NO.: L00000-01
LAB ID NO.: L00000-01-02

MATERIAL: NONWOVEN GEOTEXTILE
SAMPLE I.D. 1
ROLL NO: Not Provided

US STD. SIEVE SIZE	SIEVE OPENING (mm)	WT. FRAME & GEOTEXTILE & BEADS (gm)	WT. FRAME & GEOTEXTILE (gm)	WT. BEADS (gm)	WT. PAN & BEADS (gm)	WT. PAN (gm)	WT. BEADS PASSING (gm)	PERCENT PASSING (%)	AOS @ 5% PASSING (mm)
SPECIMEN 1									
#140	0.106	767.32	717.32	50.00	677.78	663.78	14.00	28.00	
#100	0.150	765.18	715.18	50.00	663.94	663.78	0.16	0.32	**0.141**
SPECIMEN 2									
#140	0.106	738.56	688.56	50.00	818.08	805.02	13.06	26.12	
#100	0.150	735.94	685.94	50.00	805.12	805.02	0.10	0.20	**0.141**
SPECIMEN 3									
#140	0.106	1335.37	1285.35	50.02	368.97	363.51	5.46	10.92	
#100	0.150	1335.82	1285.76	50.06	363.92	363.51	0.41	0.82	**0.130**
SPECIMEN 4									
#140	0.106	738.56	688.54	50.02	670.96	663.28	7.68	15.35	
#100	0.150	738.95	688.92	50.03	664.02	663.28	0.74	1.48	**0.137**
SPECIMEN 5									
#140	0.106	764.82	714.80	50.02	807.60	804.04	3.56	7.12	
#100	0.150	764.93	714.92	50.01	804.36	804.04	0.32	0.64	**0.119**

AVERAGE AOS @ 5% PASSING, mm 0.134
AVERAGE AOS, US STD. SIEVE SIZE #100



* NOTE: Larger bead size was run first through each specimen followed by the smaller bead size(s).

Checked By: _____ DATE: _____

TRANSMISSIVITY TEST RESULTS

ASTM D 4716-99

CLIENT: GEOSYNTHETIC INSTITUTE
CLIENT PROJECT: GAI/LAP PROFICIENCY TESTING

CLIENT PROJ. NO.: Not Provided
PROJECT NO.: L00101-01

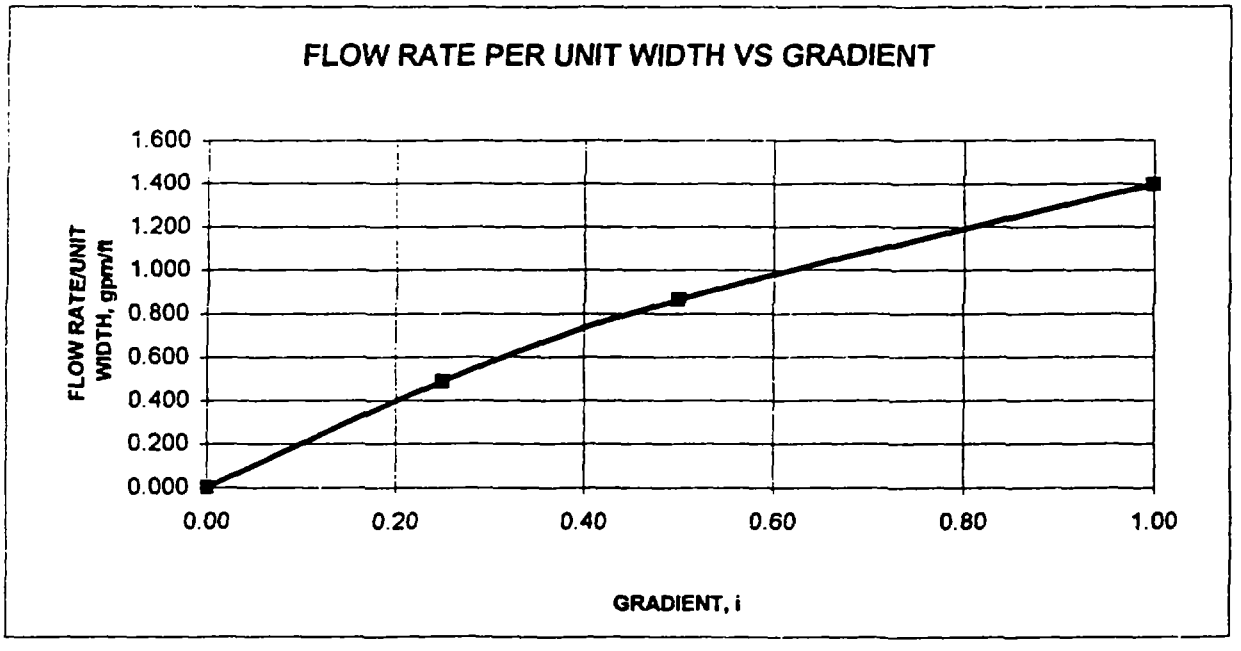
LAB ID NO.: L00101-01-01
MATERIAL: GEOCOMPOSITE
SAMPLE I.D.: GC-2
ROLL NO: Not Provided

TEST SECTION: LOADING PLATEN
COMPOSITE
FOAM SUPERSTRATUM

300 PSF NORMAL COMPRESSIVE STRESS

RES. Head h_r	WEIR Head h_w	HYDR. GRAD. i	COLLECTION DATA COL.DIV.	VOLUME (ml)	TIME (seconds)	AVERAGE FLOW RATE (gpm/ft)	AVERAGE FLOW RATE (m^3/m-sec)	CALCULATED TRANSMISSIVITY (m^2/sec)
12.30	0.30	1.000	NA	1,760	20.0	1.395	2.89E-04	2.89E-04
			NA	1,760	20.0			
			NA	1,760	20.0			
6.30	0.30	0.500	NA	1,090	20.0	0.864	1.79E-04	3.58E-04
			NA	1,090	20.0			
			NA	1,090	20.0			
3.20	0.20	0.250	NA	920	30.0	0.486	1.01E-04	4.02E-04
			NA	920	30.0			
			NA	920	30.0			

Volume/Coll. Division,L: 1.4266



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Geotechnics

PERMITTIVITY TEST RESULTS

ASTM D 4491-99
CONSTANT HEAD TEST

CLIENT: ENVIRONMENTAL ENGINEERS, INC.
CLIENT PROJECT: COMMUNITY LANDFILL
CLIENT PROJ. NO.: 00-000
PROJECT NO.: L98100-00
LAB IDNO.: L98100-00-00
MATERIAL: GEOTEXTILE
SAMPLE I.D. GT-1
ROLL NO: 04074

SPECIMEN NO.	1	2	3	4	
SPEC.THICKNESS, mils	252.5	200.4	183.4	186.6	
CONSTANT HEAD, in	2	2	2	2	
COLLECTION DIVISIONS	20	20	20	20	
READING NO.	COLLECTION TIME, sec				
1	68.7	55.7	51.6	36.2	
2	68.6	55.7	51.6	36.2	
3	68.4	55.7	51.7	36.3	
4	68.5	55.7	51.4	36.3	
5	68.5	55.8	51.8	36.3	SAMPLE
AVERAGE, sec	68.54	55.72	51.61	36.24	AVERAGE
PERMITTIVITY @ 20 C,sec-1	1.00	1.23	1.33	1.89	1.36 sec-1
PERMEABILITY @ 20 C, cm/sec	0.64	0.63	0.62	0.90	0.696 cm/sec
FLOW RATE @ 2" CONSTANT HEAD gpm/s.f.	89.8	110.5	119.3	169.8	122.3 gpm/s.f.

TEST PARAMETERS

QUANTITY COLLECTED PER DIV., cc	353
SPECIMEN DIA., cm	5.08
AREA, cm2	20.27
TEMP, C°	20.2
CORRECTION FACTOR, Rt	1.00
OXYGEN CONTENT, ppm	< 6

CHECKED BY:_____ DATE:_____

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GCL INDEX FLUX & PERMEABILITY TEST

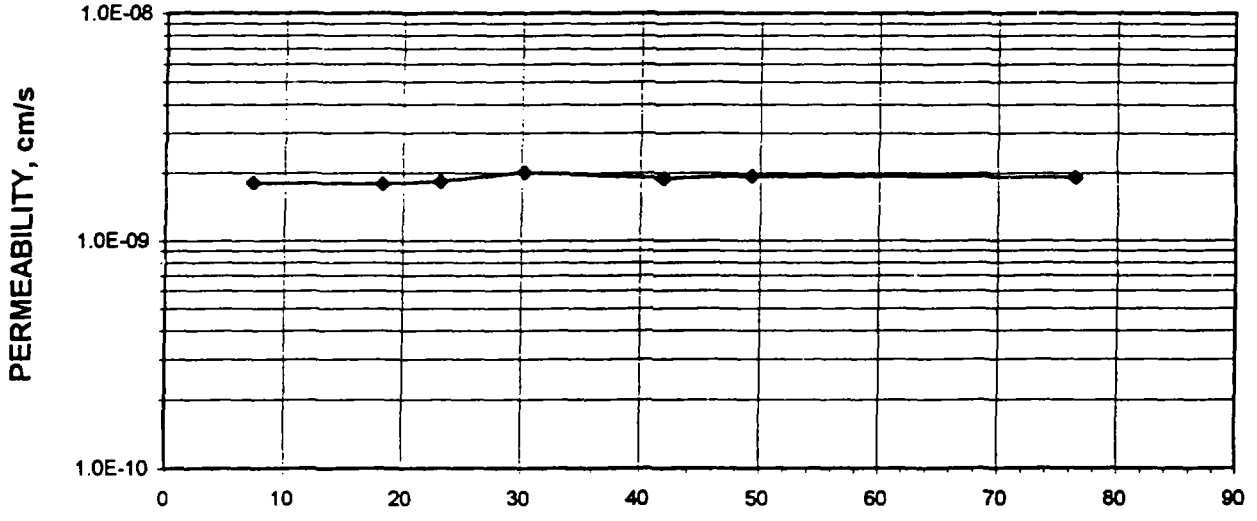
ASTM D 5887-99

Lab ID No.	L00000-01-04	Material	GCL
Client	QA ENGINEER, INC.	Roll I.D.:	np
Client Project	SANITARY LANDFILL	Sample No.	GCL-3
Project No.	L00000-01-04		

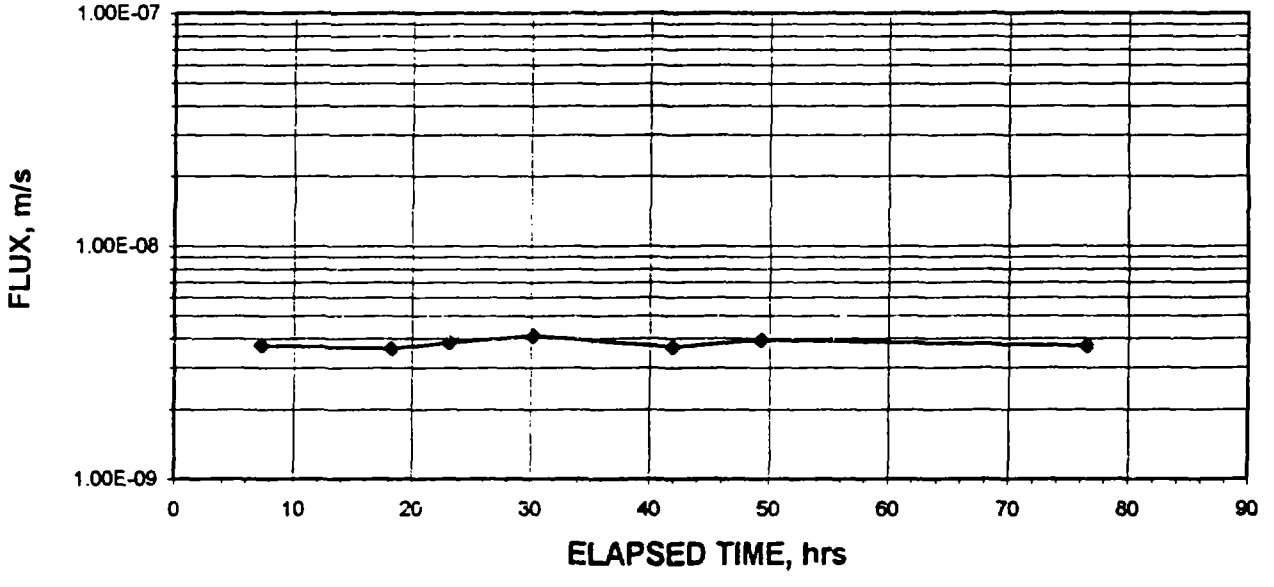
AVERAGE FLUX = 3.86E-09 m/s

AVERAGE PERMEABILITY = 1.93E-09 cm/s @ 20°C

PERMEABILITY VS. ELAPSED TIME



FLUX VS. ELAPSED TIME



Checked By: Date:

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GCL INDEX FLUX & PERMEABILITY TEST

ASTM D 5887-99

Lab ID No.	L00000-01-04	Tested by: JCM	Date: 2/5/00
Client	QA ENGINEER, INC.		
Client Project	SANITARY LANDFILL	Checked by:	Date:
Project No.	L00000-01-04		
Material	GCL		
Roll I.D.:	np		
Sample No.	GCL-3		

Permeant: DEAIRED, DEIONIZED WATER

MOISTURE CONTENT:	BEFORE TEST	AFTER TEST
ɜ Number	544	582
Wt. of Tare & GCL (gm.)	222.90	183.13
Wt. of Tare & Dry GCL (gm.)	204.18	126.58
Wt. of Tare (gm.)	84.74	84.06
Wt. of Water (gm.)	18.72	56.55
Wt. of Dry GCL (gm.)	119.44	42.52
GCL Moisture Content (%)	**15.7**	**133.0**

SPECIMEN:	BEFORE TEST	AFTER TEST
Wt. of GCL (gm.)	58.33	117.49
Clay Component Thickness 1 (in.) [1]	na	0.275
Clay Component Thickness 2 (in.) [1]	na	0.263
Clay Component Thickness 3 (in.) [1]	na	0.242
Average Clay Component Thickness (in.)	na	0.260
Average Clay Component Thickness (mm)	na	6.604
Specimen Dia. (in)	4.000	4.000
Specimen Area ($in.^2$)	12.57	12.57
Specimen Area (m^2)	0.00811	0.00811
Mass/Unit Area of GCL($gm./m^2$) [2]	7,192	14,487
Mass/Unit Area of GCL(psf) [2]	1.47	2.97
Mass/Unit Area of Dry GCL($gm./m^2$) [2]	6,218	
Mass/Unit Area of Dry GCL(psf) [2]	1.27	

*NOTES: 1) Direct visual measurement of exposed clay at specimen perimeter.

2) Includes weight of the textile carriers.

GCL INDEX FLUX & PERMEABILITY TEST

ASTM D 5887-99

Geotechnics

Lab ID No.	L00000-01-04
Client	QA ENGINEER, INC.
Client Project	SANITARY LANDFILL
Project No.	L00000-01-04
Material	GCL
Roll I.D.:	np
Sample No.	GCL-3

Pressure Heads (Constant)

Top Cap (psi)	75.0
Bottom Cap (psi)	77.0
Cell (psi)	80.0
Total Head (cm)	140.6

Final Sample Dimensions

Sample Length (cm), L	0.67
Sample Diameter (cm)	10.16
Sample Area (cm^2), A	81.07
Inflow Burette Area (cm^2), a-in	0.958
Outflow Burette Area (cm^2), a-out	0.960

AVERAGE FLUX = 3.86E-09 m/s

AVERAGE PERMEABILITY = 1.93E-09 cm/s @ 20oC

DATE	ELAPSED TIME t	TOTAL INFLOW	TOTAL OUTFLOW	RATIO INFLOW / OUTFLOW	TOTAL HEAD h	TEMP.	INCREMENTAL PERMEABILIT @ 20°C	INCREMENTAL FLUX @ 20°C
(m-d-y)	(hr)	(cm^3)	(cm^3)		(cm)	(°C)	(cm/sec)	(m/sec)
2/7/00	0.0	0.0	0.0	NA	144.5	19.5	NA	NA
7/00	7.3	1.0	0.6	1.67	142.9	18.5	1.80E-09	3.74E-09
2/8/00	18.3	2.3	1.6	1.44	140.5	18.0	1.79E-09	3.61E-09
2/8/00	23.2	2.8	2.2	1.27	139.3	20.0	1.83E-09	3.83E-09
2/8/00	30.3	3.7	3.0	1.23	137.5	19.5	2.01E-09	4.11E-09
2/9/00	41.9	5.0	4.2	1.19	134.9	18.0	1.89E-09	3.67E-09
2/9/00	49.3	5.8	5.1	1.14	133.2	20.5	1.93E-09	3.93E-09
2/10/00	76.5	8.8	8.0	1.10	127.0	20.0	1.91E-09	3.72E-09

Checked By: Date:

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WIDE WIDTH TENSILE STRENGTH TEST RESULTS

ASTM D 4595-94

CLIENT: QA ENGINEER, INC.
CLIENT PROJECT: SANITARY LANDFILL
CLIENT PROJ. NO.: QAE-00-1
PROJECT NO.: L00000-01
LAB ID NO.: L00000-01-05
MATERIAL: WOVEN GEOTEXTILE
SAMPLE I.D. 1
ROLL NO: n.p.

TEST	UNITS	SPECIMEN NO.						AVG	STD
		1	2	3	4	5	6		
	MD Load at 15% Elong.	1,266	1,350	1,220	1,310	1,330	1,410	1,314	66
	MD 15%Load, lb/in	158	169	153	164	166	176	**164**	8
WIDE WIDTH	Ult.-MD lbs	1,687	1,699	1,594	1,609	1,675	1,767	1,672	63
STRENGTH	Ult.-MD lbs/in	211	212	199	201	209	221	209	8
	CD Load at 15% Elong.	2,160	2,180	2,130	2,200	2,088	2,080	2,140	49
	CD 15%Load, lb/in	270	273	266	275	261	260	**267**	6
	Ult.-CD lbs	2,435	2,425	2,522	2,528	2,390	2,261	2,427	98
	Ult.-CD lbs/in	304	303	315	316	299	283	303	12
ELONGATION	Ult-MD %	24.0	21.8	22.5	21.8	22.5	21.8	22.4	0.88
	Ult-CD %	19.8	20.8	22.8	22.5	22.8	20.8	21.5	1.29

NOTES: 1) Elongations are based on crosshead extension with initial grip separation of 4.0 inches.

2) Strain rate of 0.40 in/min.was based on crosshead extension.

CHECKED BY:_____ DATE:_____

C:\My Documents\EXCEL\TESTDATA\NDDOT\[159-14-01WideGeo.xls]Sheet1

Geotechnics

INTERFACE FRICTION TEST RESULTS
ASTM D 5321-98

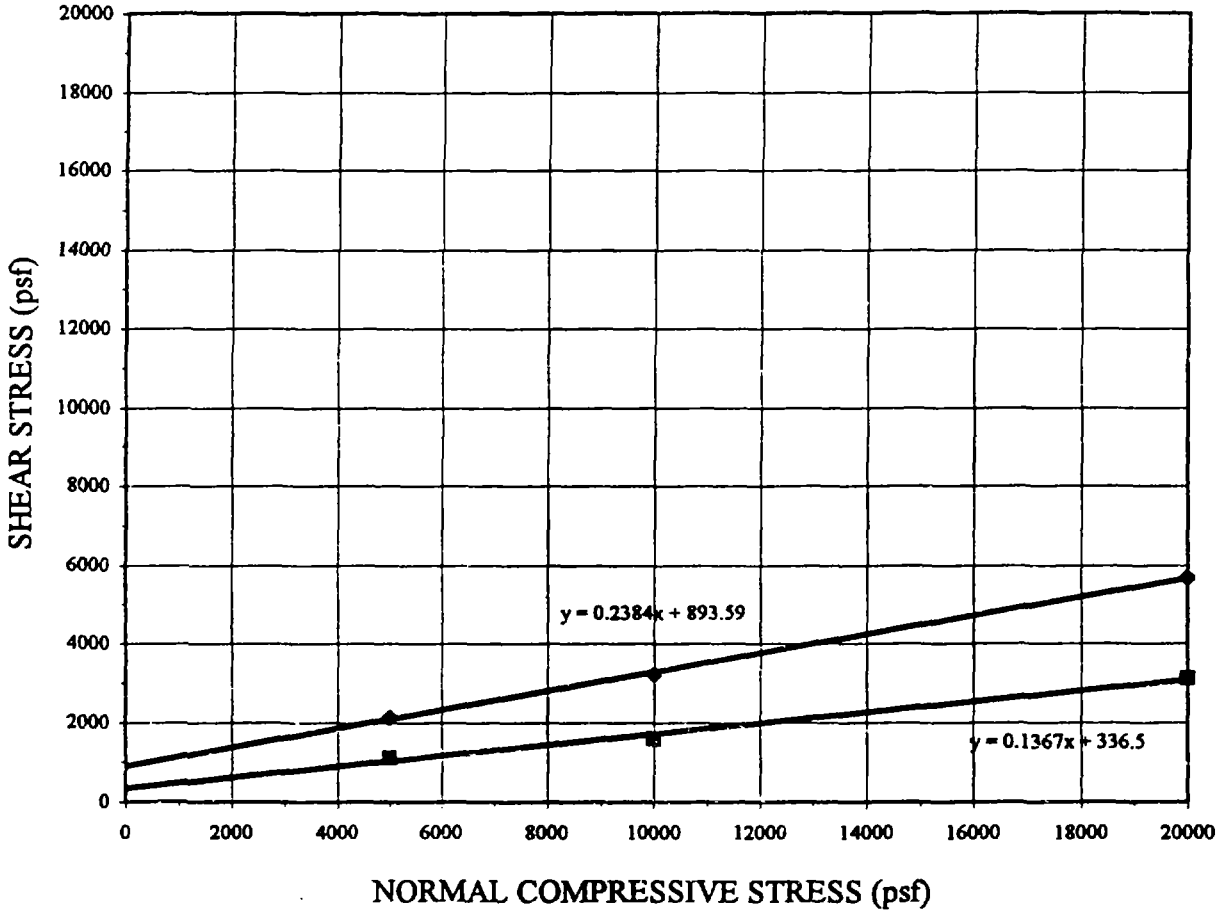
CLIENT :	GEOTECHNICS
CLIENT PROJECT :	QA
PROJECT NO. :	L00000-00
LAB I. D. NO.:	HDPE: L00000-00-01, CLAY: L00000-00-02

INTERFACE : **SILTY CLAY * VS. TEXTURED HDPE**

* Clay was placed at 102pcf @ 15.2% w. c.

	PEAK SHEAR	RESIDUAL SHEAR
FRICTION ANGLE (deg) :	Φ = 13.4	Φ = 7.8
COEFFICIENT OF FRICTION :	= 0.24	= 0.14
ADHESION [Calculated] (psf):	a = 894	a = 337

NOTES:
1.)A component of the adhesion values reported may be an anomaly of the laboratory procedure and calculation algorithm.
2.)The friction angle was calculated using linear regression basing on original data.
3.)The displacement limit for the geotest direct shear unit used is 3 inches.
4.)The interface tested "dry".



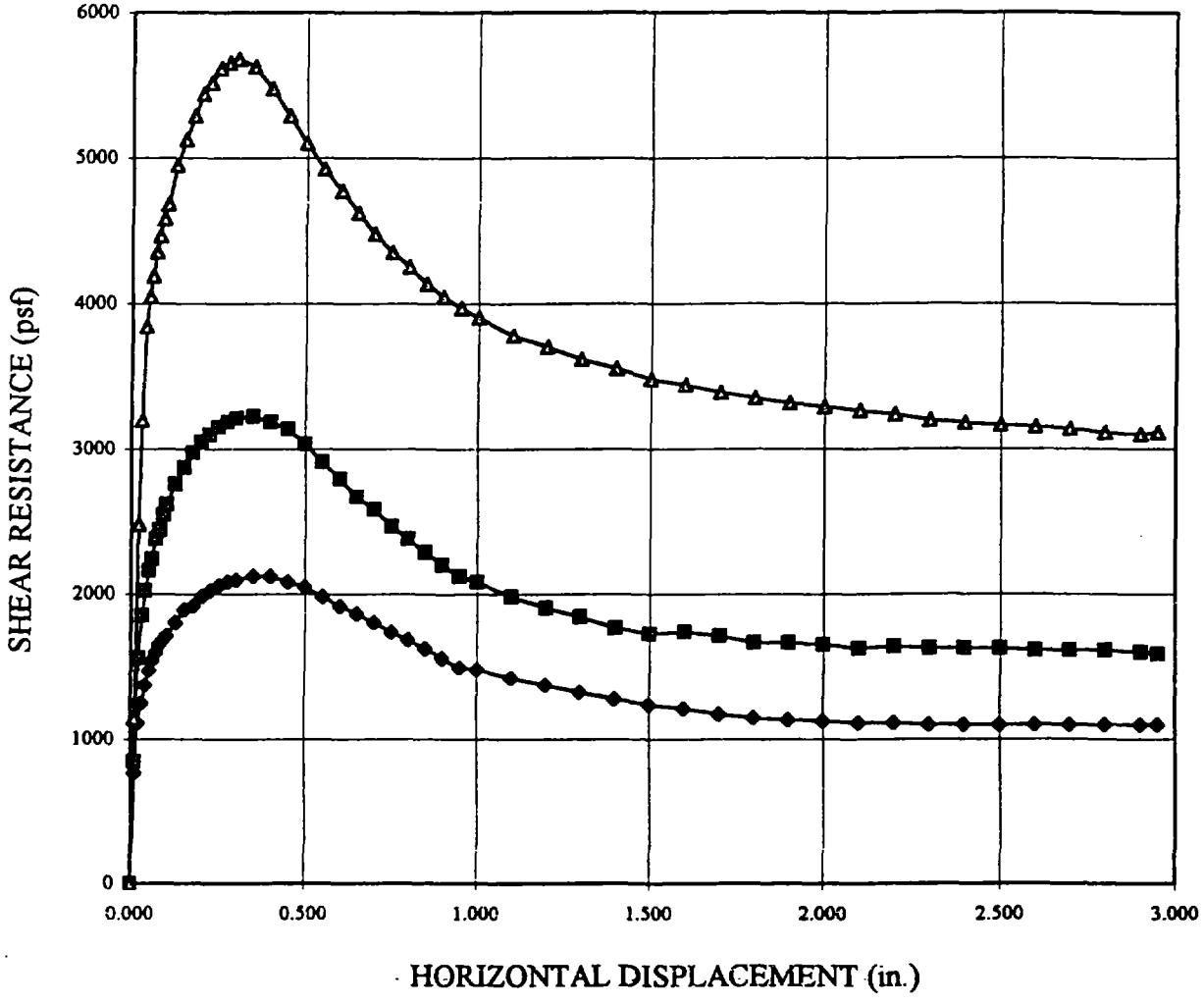
◆ PEAK SHEAR DATA ■ RESIDUAL SHEAR DATA

INTERFACE FRICTION TEST RESULTS
ASTM D 5321-98

CLIENT :	GEOTECHNICS
CLIENT PROJECT :	QA
PROJECT NO. :	*L00000-00*
LAB I. D. NO.:	HDPE: L00000-00-01, CLAY: L00000-00-02
INTERFACE :	**SILTY CLAY * VS. TEXTURED HDPE**

* Clay was placed at 102pcf @ 15.2% w. c.

SHEAR RESISTANCE VS HORIZONTAL DISPLACEMENT



INTERFACE FRICTION TEST RESULTS
ASTM D 5321-98

Geotechnics

CLIENT : GEOTECHNICS
CLIENT PROJECT : QA
PROJECT NO. : L00000-00
LAB I. D. NO.: HDPE: L00000-00-01, CLAY: L00000-00-02

DIRECT SHEAR UNIT: GEOTEST S2450

INTERFACE : **SILTY CLAY * VS. TEXTURED HDPE**
* Clay was placed at 102pcf @ 15.2% w. c.

STRAIN RATE (in / min) : 0.01

NORMAL LOAD: PNEUMATIC CYLINDERS

TEST DATA

NORMAL LOAD (psf)	5000	NORMAL LOAD (psf)	10000	NORMAL LOAD (psf)	20000
NORMAL LOAD (psi)	34.7	NORMAL LOAD (psi)	69.4	NORMAL LOAD (psi)	138.9
PEAK SHEAR STRESS (psf)	2122	PEAK SHEAR STRESS (psf)	3223	PEAK SHEAR STRESS (psf)	5679
RESIDUAL SHEAR STRESS (psf)	1096	RESIDUAL SHEAR STRESS (psf)	1590	RESIDUAL SHEAR STRESS (psf)	3109

HORIZONTAL			HORIZONTAL			HORIZONTAL		
DISPLACE. (in.)	SHEAR FORCE (lbs)	STRESS (psf)	DISPLACE. (in.)	SHEAR FORCE (lbs)	STRESS (psf)	DISPLACE. (in.)	SHEAR FORCE (lbs)	STRESS (psf)
0.000	0	0	0.000	0	0	0.000	0	0
0.010	733	767	0.010	806	843	0.010	1095	1145
0.020	1060	1108	0.020	1496	1564	0.020	2368	2476
0.030	1193	1248	0.030	1774	1855	0.030	3058	3198
0.040	1314	1374	0.040	1932	2020	0.040	3676	3844
0.050	1411	1476	0.050	2065	2159	0.050	3869	4046
0.060	1484	1552	0.060	2138	2236	0.060	4003	4186
0.070	1532	1602	0.070	2271	2375	0.070	4160	4350
0.080	1581	1653	0.080	2331	2438	0.080	4269	4464
0.090	1617	1691	0.090	2428	2539	0.090	4378	4578
0.100	1641	1716	0.100	2501	2615	0.100	4475	4680
0.125	1726	1805	0.125	2634	2755	0.125	4729	4945
0.150	1811	1894	0.150	2743	2868	0.150	4899	5123
0.175	1835	1919	0.175	2840	2970	0.175	5056	5287
0.200	1895	1982	0.200	2913	3046	0.200	5201	5439
0.225	1932	2020	0.225	2961	3096	0.225	5274	5515
0.250	1968	2058	0.250	3010	3148	0.250	5371	5617
0.275	1992	2083	0.275	3046	3185	0.275	5407	5654
0.300	2004	2096	0.300	3070	3210	0.300	5431	5679
0.350	2029	2122	0.350	3082	3223	0.350	5383	5629
0.400	2029	2122	0.400	3046	3185	0.400	5238	5478
0.450	1992	2083	0.450	2997	3134	0.450	5056	5287
0.500	1956	2045	0.500	2901	3034	0.500	4874	5097
0.550	1895	1982	0.550	2779	2906	0.550	4705	4920
0.600	1835	1919	0.600	2670	2792	0.600	4560	4769
0.650	1786	1868	0.650	2549	2666	0.650	4414	4616
0.700	1726	1805	0.700	2465	2578	0.700	4281	4477
0.750	1665	1741	0.750	2356	2464	0.750	4160	4350
0.800	1617	1691	0.800	2271	2375	0.800	4063	4249
0.850	1556	1627	0.850	2186	2286	0.850	3954	4135
0.900	1496	1564	0.900	2101	2197	0.900	3869	4046
0.950	1435	1501	0.950	2029	2122	0.950	3797	3971
1.000	1423	1488	1.000	1992	2083	1.000	3736	3907
1.100	1363	1425	1.100	1895	1982	1.100	3615	3780
1.200	1314	1374	1.200	1823	1906	1.200	3542	3704
1.300	1266	1324	1.300	1762	1843	1.300	3458	3616
1.400	1217	1273	1.400	1690	1767	1.400	3397	3552
1.500	1181	1235	1.500	1653	1729	1.500	3324	3476
1.600	1157	1210	1.600	1665	1741	1.600	3288	3438
1.700	1120	1171	1.700	1641	1716	1.700	3240	3388
1.800	1096	1146	1.800	1593	1666	1.800	3203	3350
1.900	1084	1134	1.900	1593	1666	1.900	3167	3312
2.000	1072	1121	2.000	1581	1653	2.000	3143	3287
2.100	1060	1108	2.100	1556	1627	2.100	3119	3262
2.200	1060	1108	2.200	1569	1641	2.200	3094	3236
2.300	1048	1096	2.300	1556	1627	2.300	3058	3198
2.400	1048	1096	2.400	1556	1627	2.400	3034	3173
2.500	1048	1096	2.500	1556	1627	2.500	3022	3160
2.600	1048	1096	2.600	1544	1615	2.600	3010	3148
2.700	1048	1096	2.700	1544	1615	2.700	2997	3134
2.800	1048	1096	2.800	1544	1615	2.800	2973	3109
2.900	1048	1096	2.900	1532	1602	2.900	2961	3096
2.950	1048	1096	2.950	1520	1590	2.950	2973	3109

CHECKED BY : _____ DATE : _____